d. Manual overload reset button.
e. Horsepower rated for motor applications.
f. Direct control (no contactors, relays, or holding coils).
g. Complete isolation of inverter in LINE position.
h. NEMA 12 type metal enclosures.
i. Terminal strip provided for field power supply wiring.
j. Lug connection for field ground wire.
k. Gold flashed, auxiliary switch contact set (for switch position monitoring).
l. Factory mounted, wired to VFD and motor, and run tested (motor and VFD must be factory supplied and installed).
m. UL; UL, Canada; CE listed.

2. 200-230 v/3 Ph/60 Hz (10 to 75 Hp), 460-575 v/3 Ph/60 Hz (25 to 150 Hp), 380 v/3 Ph/50 Hz (20 to 75 Hp):
   a. 4-position panel-mounted disconnect style switch with lockable handle (locks not provided), meets OSHA 1910.
   b. Switch position indication (LINE/OFF/DRIVE/TEST).
   c. Adjustable motor overload with trip indication (in LINE position).
   d. Manual overload reset button.
   e. Horsepower rated for motor applications.
   f. 115-v control transformer with fused secondary (fused primary on units over 50 amps).
   g. Contactor for Line Start/Stop.
   h. Door-mounted Line Start and Line Stop pushbuttons.
   i. Complete isolation of inverter in LINE position.
   j. NEMA 12 type metal enclosures.
   k. Terminal strip provided for field power supply wiring.
   l. Lug connection for field ground wire.
   m. Gold flashed, auxiliary switch contact set (for switch position monitoring).
   n. Factory mounted, wired to VFD and motor, and run tested (motor and VFD must be factory supplied and installed).
   o. UL; UL, Canada; CE listed.

E. Variable Frequency Drives:
1. Factory-mounted variable frequency drives (VFDs) shall be wired to factory-supplied motors.
2. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 24-month warranty from date of commissioning or 30 months from date of sale, whichever occurs first.
3. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.
4. The VFD package as specified herein shall be enclosed in a UL Listed type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO 9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and –35% nominal voltage as a minimum.
   a. Environmental operating conditions: VFDs shall be capable of continuous operation at 0 to 50 C (32 to 122 F) ambient temperature as per VFD manufacturers documented/submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFD's that can only operate at 40 C intermittently (average during a 24 hour period) and therefore, must be oversized. VFDs shall be capable of operating at altitude 0 to 3300 feet above sea level and less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
   b. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable. Type 1 enclosures with only NEMA rating are not acceptable (must be UL Type 1).
5. All VFDs shall have the following standard features:
   a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
   b. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
   c. There shall be a built-in timeclock in the VFD keypad. The clock shall have a battery back-up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor back-up is not acceptable. The clock

shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the timeclock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

d. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

e. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.

f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

g. The VFD shall have the ability to automatically restart after an overcurrent, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.

i. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add an AC line reactor.

j. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFDs with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.

k. The VFD shall include a coordinated AC transient surge protection system consisting of 4 to 120 joule rated MOVs (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

l. The VFD shall provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and/or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

m. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure/jam condition causing motor overload

n. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and/or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.

o. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and/or over the serial communication bus.

p. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

6. All VFDs to have the following adjustments:

a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.

b. Two (2) PID set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter

supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.

c. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (ie. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.

d. Two (2) programmable analog inputs shall accept current or voltage signals.

e. Two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.

f. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC or 24VAC.

g. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.

h. Run permissive circuit: There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.

i. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 to 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications).

j. Seven (7) programmable preset speeds.

k. Two independently adjustable accelerate and decelerate ramps with 1 to 1800 seconds adjustable time ramps.

l. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.

m. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.

n. The VFD shall include password protection against parameter changes.

7. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alphanumeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
   a. Start-up assistant
   b. Parameter assistants
   c. PID assistant
   d. Reference assistant
   e. I/O assistant
   f. Serial communications assistant
   g. Option module assistant
   h. Panel display assistant
   i. Low noise set-up assistant
   j. Maintenance assistant
   k. Troubleshooting assistant
   l. Drive optimizer assistants
8. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all

times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

a. Output Frequency
b. Motor Speed (RPM, %, or Engineering units)
c. Motor Current
d. Motor Torque
e. Motor Power (kW)
f. DC Bus Voltage
g. Output Voltage

9. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from –500 Hz (reverse) to 500 Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
10. Serial Communications:
    a. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
    b. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
        1) Data Sharing – Read Property – B.
        2) Data Sharing – Write Property – B.
        3) Device Management – Dynamic Device Binding (Who-Is; I-Am).
        4) Device Management – Dynamic Object Binding (Who-Has; I-Have).
        5) Device Management – Communication Control – B.
    c. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
    d. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
    e. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO and AO commands in memory in the event the serial communications connection is lost and continue controlling the process.
11. EMI/RFI filters: All VFDs shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
12. All VFDs through 75 hp at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.
13. Operational Functions:
    a. The drive shall contain two separate acceleration/deceleration times with auto tuning for optimum setting (0.1 to 6000 seconds) with

choice of linear, S, or C curves that shall be factory programmed to match the fan load and prevent nuisance overcurrent fault trips.

b. The drive shall be equipped with both local/remote and manual/auto keys on touchpad.

c. The drive shall be equipped with a quick setup key.

d. The drive shall contain 15 preset speeds, which can be activated from the keypad, terminal inputs, and host computer.

e. The drive shall have the capability of storable special custom user setting.

f. The drive shall restart into a rotating motor operating in either the forward or reverse direction and match that frequency.

g. The drive shall have adjustable soft stall (10% to 150%) which reduces frequency and voltage of the inverter to sustain a run in an overload situation factory programmed for each motor's characteristics.

h. The drive shall be capable of performing a time base pattern run using 4 groups of 8 patterns each using the 15 preset speed values for a maximum of 32 different patterns.

i. The drive shall have adjustable UL listed electronic overload protection (10% to 100%) factory programmed to match each motor's FLA/RLA ratings.

j. The drive shall have a custom programmable volt/hertz pattern.

14. Protective Features:

a. The drive shall be rated for 200,000 AIC (ampere interrupting capacity). The use of input fuses to achieve this rating shall not be acceptable.

b. The drive shall have external fault input.

c. The drive shall be capable of resetting faults remotely and locally.

d. The drive shall be programmable to alert the following alarms:

1) Over torque alarm.
2) Inverter overload pre-alarm.
3) Motor overload pre-alarm.
4) Braking resistor overload pre-alarm.
5) Inverter overheat pre-alarm.
6) Undercurrent alarm.
7) Overcurrent pre-alarm.
8) Communication error alarm.
9) Cumulative timer alarm.
10) Executing retry.

e. The drive shall identify and display the following faults:

1) Overcurrent during acceleration trip.
2) Overcurrent during deceleration trip.
3) Overcurrent during normal run trip.
4) Overcurrent on the DC Bus during acceleration trip.
5) Overcurrent on the DC Bus during deceleration trip.
6) Overcurrent on the DC Bus during normal run trip.
7) Load end overcurrent trip detected at start-up (output terminals, motor wiring, etc.).
8) U-phase short circuit trip detected at start-up.
9) V-phase short circuit trip detected at start-up.
10) W-phase short circuit trip detected at start-up.
11) Overvoltage during acceleration trip.
12) Overvoltage during deceleration trip.
13) Overvoltage during normal (constant speed) run trip.
14) Inverter overloaded trip.
15) Motor overloaded trip.
16) Inverter overheat trip.
17) Emergency off trip message.
18) EEPROM failure during write cycle.
19) EEPROM abnormality during initial reading.
20) RAM error.
21) ROM error.
22) CPU error.
23) Communication interruption error.
24) Gate array error.
25) Output current detection circuit error.
26) Option PCB error trip.
27) Low operating current trip.
28) Main circuit under voltage trip.
29) Over torque trip.
30) Software detected earth fault trip.
31) Hardware detected earth fault trip.
32) Inverter type form mismatch error.
33) EEPROM type form mismatch error.

15. Monitor Functions:

a. The drive digital display shall be capable of displaying the following: Frequency, percent current, current amps, percent voltage I/O, voltage in volts I/O, RPM, GPM, I/O watts, torque, and input reference signal, kWh.

b. The drive shall have 320 programmable parameters which can be changed while the drive is operating.

c. The drive's 353 parameters shall be adjustable from the 8-key touchpad or computer link.

d. The drive's 8-key touchpad shall be NEMA 12 rated.

e. The drive's keypad shall be capable of being extended 15 ft from the drive.

f. The drive shall contain a reset of all parameters to factory default settings or user defaults (whichever one is chosen).

g. The drive shall have 2 programmable analog outputs programmable to 17 choices.

h. The drive shall have one programmable relay output programmable to 67 choices.

i. The drive shall have 8 programmable digital inputs programmable to 54 choices.

j. The drive shall have a pulse train out-put proportional to frequency (48, 96, 360 times frequency).

k. The drive shall have an elapsed time meter.

AHU-1, AHU-2

Guide specifications — outdoor unit

39M Central Station Air Handler Units

HVAC Guide Specifications

Size Range: **1,500 to 60,500 Nominal Cfm**

Carrier Model Number: **39MW — Outdoor Unit**

Part 1 — General

1.01 QUALITY ASSURANCE

A. Manufacturer Qualifications:

Company specializing in manufacturing the products specified in this section with minimum of 5 years documented experience.

B. Units shall be manufactured in a facility registered to ISO 9001 manufacturing quality standard.

C. Air-handling unit assembly shall have UL 1995 certification for safety, including use with electric heat.

D. Products requiring electric connection shall be listed and classified by ETL and CSA as suitable for the purpose specified and indicated.

E. Coil performance shall be certified in accordance with AHRI Standard 410.

F. Air-handling unit shall be AHRI 430 listed and meet NFPA 90A requirements.

1.02 DELIVERY, STORAGE AND PROTECTION

Inspect for transportation damage and store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.03 START-UP REQUIREMENTS

Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly trapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been test run under observation.

Part 2 — Products

2.01 GENERAL DESCRIPTION

A. Units shall ship in the number of sections necessary to meet project requirements and shall ship in as many splits as specified in selection software. Split options as follows:

1. Shipped in sections — shipping split.
2. Shipped assembled.

B. Unit shall be factory-supplied, factory-assembled, outdoor, curb-mounted central station air handler. The air-handling unit may consist of a fan with the following factory-installed components as indicated on the equipment schedule.

1. Mixing Box Section:
   a. With angle filter tracks.
   b. No filter tracks.
2. Air Mixer Section.
3. Exhaust Box Section.
4. Integral Face and Bypass Section:
   a. With hot water coil.
   b. With steam coil.
5. Internal Face and Bypass Damper Section.
6. Plenum Section:
   a. With drain pan.
   b. No drain pan.
7. Humidifier Section.
8. Blow-Thru Discharge Plenum.
9. Filter Section:
   a. 2-in. flat filters.
   b. 4-in. flat filters.
   c. 2-in. angle filters.
   d. 4-in. angle filters.
   e. Side loading 12-in. bag/cartridge filters with 2-in. pre-filters.
   f. Side loading 30-in. bag/cartridge filters with 2-in. pre-filters.
   g. Face loading bag/cartridge filters without pre-filters. Maximum bag/cartridge filter length is limited to access/plenum sections placed after this section.
   h. Face loading HEPA (high-efficiency particulate air) bag/cartridge filters without pre-filters.
10. Coil Section:
    a. Chilled water coil.
    b. Direct expansion coil.
    c. Hot water coil.
    d. Steam coil.
    e. Electric coil.
11. Fan Section:
    a. Horizontal draw-thru.
    b. Horizontal blow-thru (with integral diffuser).
    c. Plenum fan.

2.02 CASING

A. Construction:

1. Unit shall be constructed of a complete frame with easily removable panels. Removal of any panel shall not affect the structural integrity of the unit.
2. All units shall be supplied with a perimeter, 14-gage or heavier, G-90 galvanized, high tensile steel base rail with a pocket to accommodate roof curb. Perimeter lifting lugs for overhead lifting shall be provided. Slinging units in place of lifting lugs shall not be acceptable.
3. Unit shall be thermally broken to minimize the conduction path from the inside of the casing to the outside.

4. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following exterior finishes as specified:
   a. Pre-painted with a baked enamel finish passing 500-hour salt spray test (ASTM B-117) for pre-painted steel and 125-hour marine level 1 prohesion test (ASTM G-85.A5) for pre-painted steel.
   b. Unpainted G-90 galvanized steel.
5. Casing panels (top, sides, and bottom) shall be constructed of galvanized steel, and shall have one of the following interior finishes as specified:
   a. Pre-coated with a silver zeolite antimicrobial material registered by the US EPA for use in HVAC applications.
   b. Unpainted G-90 galvanized steel.
6. Roof shall be double-wall, pitched in four directions at a minimum roof slope of 1/4-in. per foot across the width of the unit. No penetrations shall be made in pressure sensitive panels. Roof shall incorporate a standing top seam. All seams in the roof shall be gasketed and capped to prevent water infiltration into the unit.
7. Casing panels (top, sides, and bottom) shall be one piece double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.
8. Casing deflection shall not exceed a 1:200 ratio when subject to an internal pressure of ± 8-in. wg. Casing leakage rate shall be less than 1% at ± 8 in. wg of nominal unit airflow or 50 cfm, whichever is greater. Leakage rate shall be tested and documented on a routine basis on random production units. Optionally, factory witness leak testing and/or test reports shall be available.
9. Side panels shall be easily removable for access to unit and shall seal against a full perimeter automotive style gasket to ensure a tight seal.
10. The panel retention system shall comply with UL 1995 which states all moving parts (for example, fan blades, blower wheels, pulleys, and belts) that, if accidentally contacted, could cause bodily injury, shall be guarded against accidental contact by an enclosure requiring tools for removal.
11. Base rail shall overhang the curb to facilitate water run-off and protection of the curb to base connection from water intrusion.
12. Accessibility options shall be as follows:
    a. Hinged double-wall access door on either side with removable access panel(s) on the other side.
    b. Hinged double-wall access doors on both sides.
    c. Removable double-wall access panels on both sides.
13. Depending on the options selected and the remaining available space inside each section, the following options may be available:
    a. Thermal pane reinforced glass viewports shall be factory-installed on the access panel(s) or door(s) of this section.
    b. Marine lights shall be factory-installed with or without GCFI (ground fault circuit interrupter) convenience outlets.
14. Fan supports, structural members, panels, or flooring shall not be welded, unless aluminum, stainless steel, or other corrosion-resistant material is used. Painted welds on unit exterior steel or galvanized steel are not acceptable.
15. All coil sections shall be solid double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.
16. Blow-thru fan sections shall have a diffuser plate as an integral part of the fan section.

B. Access Doors:

Access doors shall be one piece double-wall construction with insulation sealed between the inner and outer panels. Panel assemblies shall not carry an R-value of less than 13.

C. Drain Pans:

Drain pans shall be insulated double-wall galvanized or stainless steel construction. The pan shall be sloped toward the drain connection. Drain pan shall have 1 1/2-in. MPT connection exiting through the hand side or opposite side of the casing as specified. Drain connection shall be insulated from the drain pan to the point at which it exits the casing. One drain outlet shall be supplied for each cooling coil section. Drain pan shall allow no standing water and comply with ASHRAE Standard 62. Where 2 or more coils are stacked in a coil bank, intermediate drain pans shall be provided and the condensate shall be piped to the bottom drain pan. The bottom coil shall not serve as a drain path for the upper coil.

D. Roof Curbs:

1. Roof curb shall be delivered to jobsite in an unassembled, knockdown state.
2. Curb shall be constructed of 14-gage G-90 galvanized steel, 14 in. or 24 inches in height.
3. Full perimeter wood nailers shall be securely mounted to curb sheet metal.
4. Curb channel supports will be supplied on all curbs exceeding 10 ft in total unit airway length.
5. Gasketing between curb and unit shall be shipped for field installation with the unit curb.

6. Coil connection housing curb will be offered optionally to enclose coil piping. Multiple coil connection housings may be specified (up to two per side).

E. Hoods and Louvers:

1. Outside Air Hoods:
   a. Outside air hoods shall be constructed of 20-gage galvanized G-90 steel and sized for 100% of unit nominal cfm.
   b. Hoods shall include easily accessible 1-in. moisture eliminators with a maximum velocity of no more than 500 fpm.
2. Exhaust Air Hoods:
   a. Exhaust air hoods shall be constructed of 16-gage galvanized G-90 steel and shipped collapsed in place.
   b. Expanded metal bird screen shall be provided to prevent entry of unwanted materials into air handler.
3. Side Intake Louvers:
   a. Frames and blades shall be 6063 alloy, 0.081 in. thick, mechanically fastened with stainless steel fasteners. Frame depth shall be 6 inches.
   b. Vertical blades shall be designed to collect and drain water to exterior at sill by means of a center rain hook and channels in jambs and mullions.
   c. Louvers shall have 1/2-in. mesh removable aluminum bird screen.
   d. Visible mullions required for louver widths greater than 96 inches.
   e. Provide sill-flashing pans 4 in. high by full depth formed from minimum 0.060 in. thick aluminum.
   f. Louvers shall be designed to withstand a wind load of 25 lb per sq ft.
   g. Water penetration shall be no more than 0.01 oz per sq ft of free area at 1250 fpm per AMCA publication 511. The AMCA test was unable to determine the beginning water penetration for this louver due to the fact that it lies above 1250 fpm through free area.
   h. Louver shall have a mill finish.

2.03 FANS

A. General:

1. Forward-curved fans shall have one double-width double-inlet (DWDI) fan wheel and scroll. They shall be constructed of galvanized steel with baked enamel. They shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I or II). Completed fan assembly shall be dynamically balanced in accordance with 1989 ARI Guideline G and ANSI S2.19-1986 at design operating speed using contract drive and motor if ordered.
2. Airfoil fan sections shall have one DWDI airfoil fan wheel and scroll. Airfoil blades shall be double thickness design constructed of heavy gage, high strength steel or aluminum continuously welded to the backplate and the spun inlet flange. Entire fan assembly shall be cleaned, primed and painted with alkyd enamel, except for an aluminum fan wheel when supplied. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I, II, or III). Completed fan assembly shall be dynamically balanced to minimum grade of G 6.3 per ANSI/AMCA 204-96 at design operating speed using contract drive and motor if ordered.
3. Plenum fan sections shall have one single-width single-inlet (SWSI) airfoil fan wheel. Airfoil blades shall be double thickness design constructed of heavy gage, high strength steel or aluminum continuously welded to the backplate and the spun inlet flange. Entire fan assembly shall be cleaned, primed and painted with alkyd enamel, except for an aluminum fan wheel when supplied. They shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fans shall have an AMCA class rating corresponding to the static pressure at which the fan is designed to operate (Class I, II, or III). Completed fan assembly shall be dynamically balanced to minimum grade of G 6.3 per ANSI/AMCA 204-96 at design operating speed using contract drive and motor if ordered.
4. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected with a maximum operating speed 25% below the first critical.
5. Fan motor shall be mounted within the fan section casing on slide rails equipped with adjusting screws. Motor shall be premium efficiency, open drip-proof or totally enclosed fan cooled NEMA Design B with size and electrical characteristics as shown on the equipment schedule. Motor shall be mounted on a horizontal flat surface and shall not be supported by the fan or its structural members. All three-phase motors shall have a ±10% voltage utilization range and a 1.15 minimum service factor. Motor shall be compliant with the Energy Independence and Security Act (EISA) of 2007 where applicable. Single-phase motors shall be available up to and including 5 hp.

B. Performance Ratings:

Fan performance shall be rated and certified in accordance with AHRI Standard 430.

C. Sound Ratings:

Manufacturer shall submit first through eighth octave sound power for fan discharge and casing radiated sound.

D. Mounting:

Fan scroll, wheel, shaft, bearings, drives, and motor shall be mounted on a common base assembly. The base assembly is isolated from the outer casing with factory-installed isolators and vibration absorbent an discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable. Units shall use 2-in. deflection spring isolators.

E. Fan Accessories:

1. Forward curved fans:
   a. Variable frequency drives with or without bypass.
   b. Magnetic motor starters.
   c. Motor disconnects.
   d. Belt guards.
   e. Inlet screen.
2. Airfoil fans:
   a. Variable frequency drives with or without bypass.
   b. Magnetic motor starters.
   c. Motor disconnects.
   d. Belt guards.
   e. Inlet screen.
3. Plenum fans:
   a. Variable frequency drives with or without bypass.
   b. Magnetic motor starters.
   c. Motor disconnects.
   d. Inlet screen and wheel cage.

F. Flexible Connection:

The base assembly is isolated from the outer casing with factory-installed isolators and vibration absorbent fan discharge seal. A canvas style duct connection between fan discharge and cabinet is not acceptable.

2.04 BEARINGS AND DRIVES

A. Bearings:

Self-aligning, grease lubricated, anti-friction with lubrication fittings extended to drive side of fan section. Optional grease fittings extended to the exterior of the casing are available.

1. Size 03 to 110 forward-curved fans: Cartridge type bearings for Class I fans. Heavy-duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L_{50}) of 200,000 hours or optionally for an (L_{50}) of 500,000 hours.
2. Size 03 to 110 airfoil fans: Heavy-duty pillow block type, self-aligning, regreasable ball or roller type bearings selected for a minimum average life (L_{50}) of 200,000 hours or optionally for an (L_{50}) of 500,000 hours.
3. Size 06 to 110 plenum fans: Heavy-duty pillow block type, self-aligning, regreasable roller type bearings selected for a minimum average life (L_{50}) of 200,000 hours or optionally for an (L_{50}) of 500,000 hours.

B. Shafts:

Fan shafts shall be solid steel, turned, ground, polished and coated with a rust inhibitor.

C. V-Belt Drive:

Drive shall be designed for a minimum 1.2 service factor as standard with a 1.5 service factor option and/or a factory-supplied extra set of belts. Drives shall be fixed pitch with optional variable pitch for motors 15 hp and less. All drives shall be factory mounted, with sheaves aligned and belts properly tensioned.

2.05 COILS

A. All water, steam and direct expansion (DX) refrigerant coils shall be provided to meet the scheduled performance. All coil performance shall be certified in accordance with AHRI Standard 410. All water and direct expansion coils shall be tested at 450 psig air pressure. Direct expansion coils shall be designed and tested in accordance with ASHRAE/ANSI 15 Safety Code for Mechanical Refrigeration (latest edition).

B. General Fabrication:

1. All water and refrigerant coils shall have minimum $^1/_2$-in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.016 inches. Optional tube wall thickness of 0.025 in. shall be supplied, if specified.
2. Optionally, water coils shall have minimum $^5/_8$-in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.020 inches. Optional tube wall thickness of 0.035 in. shall be supplied, if specified.
3. Aluminum plate fin type with belled collars. Optional copper plate fins shall be supplied, if specified.
4. Aluminum-finned coils shall be supplied with die-formed casing and tube sheets of mill galvanized steel or stainless steel as specified. Copper-finned coils shall be supplied with stainless steel casing and tube sheets.

C. Hydronic Heating and Cooling Coils:

1. Headers shall be constructed of steel with steel MPT connections. Headers shall have drain and vent connections accessible from the exterior of

the unit. Optional non-ferrous headers and red brass nipples shall be supplied if specified.

2. Configuration: Coils shall be drainable, with non-trapping circuits. Coils will be suitable for a design working pressure of 300 psig at 200 F.

D. Steam Distribution (Non-Freeze Type) Heating Coils:
   1. Headers shall be steel with MPT connections.
   2. Inner steam distributing tubes shall be 5/8-in. OD, 0.020 in. wall thickness, located within 1 in. OD, 0.030 in. wall outer condensing tubes. Working pressure shall be 175 psig at 400 F.
   3. Inner steam distributing tubes shall be 3/8-in. OD, 0.020 in. wall thickness, located within 5/8-in. OD, 0.035 in. wall outer condensing tubes. Working pressure shall be 175 psig at 400 F.

E. Integral Face and Bypass Coils:
   1. Sizes 03-14 shall have horizontal steam or hot water coils with a tubewall thickness of not less than 0.020 inches. Tubes shall be mechanically expanded into die formed collars formed in aluminum plate type fins.
   2. Sizes 17-110 shall have vertical steam or hot water coils with a tubewall thickness of not less than 0.035 inches. Fins shall be spiral edge-wound copper. Tubes shall be free-floating for thermal expansion and contraction without the use of offset bends or floating headers.

F. Refrigerant Coils:
   1. Headers shall be constructed of copper with brazed joints.
   2. Standard circuiting selections include:
      a. Single distributor arrangement for sizes 03-17.
      b. Row split intertwined, multiple distributor arrangement for sizes 03-110.
      c. Face split, multiple distributor arrangement for sizes 03-110.
   3. Replaceable nozzle, brass refrigerant distributors and seamless copper distribution tubes are supplied to ensure uniform flow.

G. Electric Heating Section:
   1. The electric heater casing is constructed of galvanized steel. Heater control box access door shall be mounted on the designated hand side of the unit. Element construction as follows:
      a. Open-wire type, 80% nickel, 20% chromium resistance coils, insulated by Steatite bushings and supported in a galvanized steel frame. Bushings shall be recessed into embossed openings and stacked into supporting brackets, spaced no more than 4-in. centers. Thermal cutouts for overtemperature protection shall be provided to meet UL and NEC requirements. Maximum element heating density shall be 55 watts/sq inch.
      b. Sheathed type, 80% nickel, 20% chromium resistance coils, suspended in a magnesium oxide insulator fill within a tubular steel sheath/brazed fin assembly. Silicone rubber end seals shall prevent contamination of the interior, and the exterior shall be protected from corrosion by a high temperature aluminum coating. Thermal cutouts for overtemperature protection shall be provided to meet UL and NEC requirements. Maximum element heating density shall be 55 watts/sq inch.
   2. The manufacturer shall furnish an integral control box containing thermal cutouts, primary control, subcircuit fusing, airflow switch, and fused control transformer.
   3. Electric heaters shall be UL listed for zero clearance and shall meet all applicable National Electric Code requirements.
   4. Units with electric heat sections shall be listed under UL 1995 Standard for Safety.

2.06 HUMIDIFIERS

A. The humidifiers shall be of the direct discharge type, using steam from existing steam lines or boilers to be injected into the air plenums for humidification.

B. Each humidifier shall consist of multiple, vertical steam discharge pipes, supported on horizontal header manifolds, spaced to provide the optimum of steam to air contact while minimizing pressure drop. Each humidifier shall be sized to nominally match the air plenum width and height for maximum contact of the discharging steam to the air passing around the vertical steam discharge pipes.

C. The vertical steam discharge pipes shall be constructed of 316 stainless steel. Each pipe shall have a full-length, inverted slot on each side for steam discharge at 100% air to steam contact. Nozzles and holes have less than 15% air to steam contact and are, therefore, unacceptable.

D. A full-length stainless steel fishbone shaped baffle shall be used inside the vertical discharge pipe to wick condensate away from the discharge slots and back to the center of the pipe for re-evaporation.

E. The feeder manifolds shall be constructed of 316 stainless steel, sized to move the steam in a specific mass-flow speed range, for maximum condensate separation. Final condensate separation shall occur inside the feeder manifolds, after the control valve, with the dried steam then injected directly into the vertical discharge pipes.

F. The vertical steam discharge pipes and horizontal feeder manifolds shall be coated with a thin, non-toxic insulative coating capable of reducing surface temperature to no more than 120 F during operation, to reduce heat gain to the airstream. The insulative coating shall have an insulating value at 30 mils equal to 8 in. of R-40 foam. The insulative coating shall have a flame spread and smoke developed rating of 5 under ASTM E-84 with a

cross-hatch adhesion of 100% under ASTM D-3359, acceptable for use in air ducts.

G. The steam humidifier shall be designed with slip fittings for easy assembly. The steam humidifier shall be designed without plastic nozzles, collars, o-rings or gaskets for zero maintenance.

2.07 FILTER SECTIONS

A. Flat filter sections shall accept either 2-in. or 4-in. filters. Sections shall include side access slide rails.

B. Angle filter sections shall accept either 2-in. or 4-in. filters of standard sizes, arranged in a horizontal V formation.

C. Draw-thru bag/cartridge filter sections shall be capable of accepting headered standard size 6-in. to 12-in. deep rigid media or bag filters.

D. Draw-thru bag/cartridge filter sections shall be capable of accepting headered standard size 12-in. to 30-in. deep rigid media or bag filters.

E. Blow-thru bag/cartridge filter sections shall contain a face loading filter frame and be capable of accepting standard size 12-in. deep rigid media (headered or box) or bag filters.

F. Blow-thru HEPA filter sections shall contain a face loading filter frame and be capable of accepting standard size 12-in. deep HEPA box filters.

G. Magnehelic Gages:

1. Housing shall be constructed of a die cast aluminum case and bezel with acrylic cover. Exterior finish shall be coated gray to withstand 168 hr salt spray corrosion test.
2. Accuracy shall be ±2% of full scale throughout range at 70 F (21.1 C).
3. Pressure limits shall be –20 in. Hg to 15 psig (0.677 bar to 1.034 bar).
4. Overpressure relief plugs shall open at approximately 25 psig (1.72 kPa).
5. Temperature limits shall be 20 to 140 F (–6.67 to 60 C).
6. Diameter of dial face shall be 4 in. (101.6 mm).
7. Process connections shall be $^1/_8$-in. female NPT duplicate high and low pressure taps — one pair side and one pair back.

2.08 DAMPERS

A. Mixing boxes, filter-mixing boxes, and exhaust boxes shall have parallel or opposed blades and interconnecting outside-air and return-air dampers.

1. Standard Dampers:

   Damper blades shall be constructed of galvanized steel, with blade seals and stainless steel jamb seals. Blades shall be mechanically fastened to axle rods rotating in self-lubricating synthetic bearings. Maximum leakage rate shall be 4 cfm/ft^2 at 1 in. wg (0.25 kPa) differential pressure.

2. Premium Dampers:

   Damper blades shall be constructed of galvanized steel with a double-skin airfoil design, with blade seals and stainless steel jamb seals. Blades shall be mechanically fastened to axle rods rotating in self-lubricating synthetic bearings. Maximum leakage rate shall be 2 cfm/ft^2 at 1 in. wg (0.25 kPa) differential pressure.

3. Outside Air Measurement Dampers:

   a. Damper frame shall be nominal 4 in. x 1 in. x minimum 0.081 in. (102 mm x 25 mm x minimum 2 mm) and constructed of 6063-T5 extruded aluminum.

   b. Airflow measuring blades shall be airfoil-shaped, heavy gage anodized 6063-T5 extruded aluminum and fixed in 10 in. x minimum 16 gage (254 mm x minimum 1.5 mm) galvanized steel frame.

   c. Jamb seals shall be flexible metal compression type along control damper sides.

   d. Blade seals shall be neoprene along control damper blade edges.

   e. Bearings shall be molded synthetic.

   f. Linkage shall be galvanized steel, concealed in frame.

   g. Axles shall be minimum $^1/_2$-in. (13 mm) diameter plated steel, hex-shaped, mechanically attached to blade.

   h. Operating temperature shall be –22 to 140 F (–30 to 60 C).

   i. Air straightener section shall be aluminum alloy honeycomb contained in 5 in. (127 mm) long, 16 gage (1.5 mm) galvanized steel sleeve attached to monitoring blade frame.

   j. Airflow range shall be 400 to 5,000 ft per minute (122 to 1524 m/min) face velocity.

   k. Maximum leakage rate shall be 2 cfm/ft^2 at 1 in. wg (0.25 kPa) differential pressure.

B. Integral Face and Bypass Dampers:

1. Integral face and bypass (IFB) coils shall be capable of maintaining a constant air volume, within 5%, shall be capable of maintaining a constant leaving air temperature as entering air conditions vary, and shall be capable of producing mixed leaving air temperatures within 3 ft downstream with a maximum variance in air temperature of 5° F, regardless of damper position.
2. When no heating is required, dampers shall divert air to bypass around heating surface with minimal temperature override.
3. Coil casing, dampers and baffles shall be fabricated from galvanized steel with an option for stainless steel. Coils shall be tested at 300 psig.

4. Integral face and bypass coils shall be provided with a connection point for field-mounted actuator(s), electrical or pneumatic, or can be provided from the factory at an additional cost.
5. Actuator connection point shall be mechanically attached to dampers via linkage mechanisms. Dampers shall be interconnected for operation simultaneously across each face of coil.

C. Internal Face and Bypass Dampers:

Internal face and bypass dampers shall be factory mounted in galvanized steel frame. Damper blades shall be constructed of galvanized steel, with high temperature blade and edge seals. Blades shall be mechanically fastened to axle rods rotating in self-lubricating synthetic bearings. To eliminate blade warping, face dampers shall be sectionalized to limit blade length to 60 in. maximum. Face damper blades shall be opposed and arranged to match coil face with top bypass, and internal linkage.

2.09 AIR MIXER

Air mixer of 0.081-in. aluminum construction of size, performance and maximum pressure drop indicated. The air mixer shall mix two or more airstreams of differing temperature to within ± 6° F of theoretical mixed-air temperature and provide a more uniform air velocity contour entering a downstream filter or coil bank.

2.10 UV-C GERMICIDAL LAMPS

A. Emitters and fixtures for UV-C lamps shall be designed for use inside an HVAC system. Individual lamp output shall be measured in an ASME nozzled test apparatus using a 45 F airstream moving at not less than 400 fpm. Lamp output at 253.7 nm shall not be less than 10 $\mu W/cm^2$ per inch of arc length measured at a distance of one meter.

B. Power supplies for UV-C lamps shall be a high-efficiency electronic type which are matched to the emitters and are capable of producing the specified output intensity with an input power no more than 80 watts.

C. Fixtures for UV-C lamps shall be factory installed and wired to a SPDT disconnect switch and door interlock switches in each door. Fixtures are wired for 120 v/single ph requiring a minimum circuit ampacity of 15 amps. Lamps shall ship separately for field installation to minimize the chance for bulb damage.

D. Emitters and fixtures shall be installed in sufficient quantity and arranged so as to provide an equal distribution of UV-C energy on the coil and drain pan.

E. The minimum UV-C energy striking the leading edge of the coil pan shall be not less than 820 $\mu W/cm^2$ at the closest point and through placement, not less than 60% of that value at the farthest point. Equal amounts are to strike the drain pan, either directly or indirectly through reflection.

F. Emitters and fixtures shall be installed such that UV-C energy strikes all surfaces of the coil, drain pan, and the available line of sight airstream.

2.11 ELECTRICAL ACCESSORIES

A. Marine Lights and Convenience Outlets:

1. Cast, non-ferrous metal, weatherproof, fixture.
2. Cast, non-ferrous metal, weatherproof, electrical junction box.
3. Gasketed, heat and shock resistant glass globe protects against moisture and debris.
4. Cast, non-ferrous metal lamp guard to protect glass globe.
5. UL listed.
6. 100 watt type 'A' lamp maximum capacity.
7. Each fixture is equipped with a 75 watt, 130 volt, long life, vibration resistant, lamp (8000+ hour typical lamp life), factory installed.
8. Cast, non-ferrous metal, single gang, weatherproof, switch enclosure.
9. With convenience outlet: Factory supplied and wired, SPST, toggle switch and 15 amp, 120 vac/60 Hz, NEMA 5-15 type, ground fault circuit interrupt (GFCI) receptacle, weatherproof, 'In-Use' type, lockable cover, UL listed.
10. Without convenience outlet: Factory supplied and wired, SPST switch with non-ferrous metal, weatherproof cover plate, UL listed.
11. Each fixture is factory wired to an externally mounted switch box. (Field power connections are made to the switch box mounted externally on the unit.)
12. All factory wiring penetrating through the panel is protected in 'RIGID' type metal conduit.

B. Disconnects:

1. 115-230 volt/single-phase non-fused disconnects shall have the following characteristics:
   a. Plated current carrying components for superior corrosion protection.
   b. Factory-installed equipment grounding terminals with slot/square drive screws.
   c. Rated for motor disconnect applications (10 hp maximum).
   d. NEMA type 3R nonmetallic enclosure.
   e. Up to 10,000 rms symmetrical amperes SCCR, when protected by a fuse or circuit breaker rated 60 amperes or less.
   f. Cover padlock hasp.
   g. Pull-out cartridge type.
   h. UL listed.
2. 115-230 volt/single-phase fused disconnects shall have the following characteristics:
   a. Visible blades.

b. Quick-make, quick-break operating mechanism.
c. Cover padlock hasp and handle lock "OFF."
d. 240 vac maximum.
e. Factory supplied and installed class RK5 fuses.
f. Up to 100,000 rms symmetrical amperes SCCR, utilizing appropriately rated, factory supplied, Class R fuses.
g. Horsepower rated for motor applications.
h. Tangential combination knockouts for field wiring.
i. Spring reinforced plated copper fuse clips.
j. NEMA type 3R enclosures.
k. Insulated, bondable solid neutral assemblies.
l. UL listed, File E2875.
m. Meet or exceed NEMA KS1-1990.

3. 200-230 volt/3-phase fused and non-fused disconnects shall have the following characteristics:
a. Visible blades.
b. Quick-make, quick-break operating mechanism.
c. Cover padlock hasp and handle lock "OFF."
d. 240 vac maximum.
e. Factory supplied and installed class RK5 fuses (fused disconnects only).
f. Up to 100,000 rms symmetrical amperes SCCR, utilizing appropriately rated Class R fuses.
g. Horsepower rated for motor applications.
h. Tangential combination knockouts for field wiring.
i. Spring reinforced plated copper fuse clips.
j. NEMA type 3R enclosures.
k. Insulated, bondable solid neutral assemblies.
l. UL listed, File E2875.
m. Meet or exceed NEMA KS1-1990.

4. 380-575 volt/3-phase fused and non-fused disconnects shall have the following characteristics:
a. Visible switch blades with for positive "OFF" indication.
b. Quick-make, quick-break operating mechanism.
c. Dual cover interlock.
d. Color coded "ON" — "OFF" indicator handle.
e. Cover padlock hasp and handle lock "OFF" provision for multiple padlocks.
f. 600 vac maximum.
g. Factory supplied and installed class RK5 fuses (fused disconnects only).
h. Up to 200,000 rms symmetrical amperes SCCR, utilizing appropriately rated Class R fuses.
i. Horsepower rated for motor applications.
j. Spring reinforced plated copper fuse clips.
k. Tangential combination knockouts.
l. NEMA type 3R enclosures.
m. Insulated, bondable solid neutral assemblies.
n. Wire terminations suitable for aluminum or copper conductors.
o. UL listed.
p. Meet or exceed NEMA KS1-1999.

C. Starters:
1. Starter without disconnect:
a. Adjustable motor overload with trip indication.
b. Manual overload reset button (accessible without opening enclosure).
c. 115-v fused secondary control transformer (fuse included — fused primary and secondary over 50 amps).
d. Hand/Off/Auto selector switch (accessible without opening enclosure).
e. Separate 4-position terminal strip for remote H-O-A wiring.
f. C series contactors.
g. Horsepower rated for motor applications.
h. NEMA 4X type non-metallic enclosures.
i. Lug connections for field wiring.
j. Factory mounted, wired, and run tested with factory-supplied motor.
k. UL listed.

2. Combination Starter/Disconnect:
a. Non-fused UL 508 disconnect switch with lockable handle (locks not provided).
b. Cover interlock.
c. Adjustable motor overload with trip indication.
d. Manual overload reset button (accessible without opening enclosure).
e. 115-v fused secondary control transformer (fuse included — fused primary and secondary over 50 amps).
f. Hand/Off/Auto selector switch (accessible without opening enclosure).
g. Separate 4-position terminal strip for remote H-O-A wiring.
h. C series contactors.
i. Horsepower rated for motor applications.
j. NEMA 4X type non-metallic enclosures.
k. Lug connections for field power wiring.
l. Factory mounted, wired, and run tested with factory-supplied motor.

Guide specifications — outdoor unit (cont)

D. Bypass for Variable Frequency Drives:
   1. 200-230 v/3 Ph/60 Hz (1 to 7.5 Hp), 460-575 v/3 Ph/60 Hz (1 to 20 Hp), 380 v/3 Ph/50 Hz (1 to 15 Hp):
      a. 4-position panel-mounted disconnect style switch with lockable handle (locks not provided), meets OSHA 1910.
      b. Switch position indication (LINE/OFF/DRIVE/TEST).
      c. Adjustable motor overload with trip indication (LINE position).
      d. Manual overload reset button.
      e. Horsepower rated for motor applications.
      f. Direct control (no contactors, relays, or holding coils).
      g. Complete isolation of inverter in LINE position.
      h. NEMA 12 type metal enclosures.
      i. Terminal strip provided for field power supply wiring.
      j. Lug connection for field ground wire.
      k. Gold flashed, auxiliary switch contact set (for switch position monitoring).
      l. Factory mounted, wired to VFD and motor, and run tested (motor and VFD must be factory supplied and installed).
      m. UL; UL, Canada; CE listed.
   2. 200-230 v /3 Ph/60 Hz (10 to 75 Hp), 460-575 v/3 Ph/60 Hz (25 to 150 Hp), 380 v/3 Ph/50 Hz (20 to 75 Hp):
      a. 4-position panel-mounted disconnect style switch with lockable handle (locks not provided), meets OSHA 1910.
      b. Switch position indication (LINE/OFF/DRIVE/TEST).
      c. Adjustable motor overload with trip indication (in LINE position).
      d. Manual overload reset button.
      e. Horsepower rated for motor applications.
      f. 115-v control transformer with fused secondary (fused primary on units over 50 amps).
      g. Contactor for Line Start/Stop.
      h. Door-mounted Line Start and Line Stop pushbuttons.
      i. Complete isolation of inverter in LINE position.
      j. NEMA 12 type metal enclosures.
      k. Terminal strip provided for field power supply wiring.
      l. Lug connection for field ground wire.
      m. Gold flashed, auxiliary switch contact set (for switch position monitoring).
      n. Factory mounted, wired to VFD and motor, and run tested (motor and VFD must be factory supplied and installed).
      o. UL; UL, Canada; CE listed.

E. Variable Frequency Drives:
   1. Factory-mounted variable frequency drives (VFDs) shall be wired to factory-supplied motors.
   2. Factory-supplied VFDs are programmed and started up from the factory and qualify the VFD, through ABB, for a 24-month warranty from date of commissioning or 30 months from date of sale, whichever occurs first.
   3. The VFD parameters are programmed into the controller and removable keypad. In the event that the VFD fails and needs replacement, the program can then be uploaded to the replacement VFD via the original keypad.
   4. The VFD shall be mounted inside the unit cabinet shielded from upstream components and within the unit's ambient conditions. Access to the VFD shall be through the unit's hinged access door.
   5. The VFD package as specified herein shall be enclosed in a UL Listed type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO 9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and –35% nominal voltage as a minimum.
      a. Environmental operating conditions: VFDs shall be capable of continuous operation at 0 to 50 C (32 to 122 F) ambient temperature as per VFD manufacturers documented/submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFDs that can only operate at 40 C intermittently (average during a 24-hour period) and therefore must be oversized. VFDs shall be capable of operating at altitude 0 to 3300 feet above sea level and less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
      b. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFDs without these ratings are not acceptable. Type 1 enclosures with only NEMA ratings are not acceptable (must be UL Type 1).
   6. All VFDs shall have the following standard features:
      a. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and

downloading of parameter settings as an aid for start-up of multiple VFDs.

b. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

c. There shall be a built-in timeclock in the VFD keypad. The clock shall have a battery back-up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor back-up is not acceptable. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the timeclock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

d. The VFDs shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.

e. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.

f. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

g. The VFD shall have the ability to automatically restart after an overcurrent, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

h. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.

i. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add an AC line reactor.

j. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.

k. The VFD shall include a coordinated AC transient surge protection system consisting of 4 to 120 joule rated MOVs (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

l. The VFD shall provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and/or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

m. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure/jam condition causing motor overload

n. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and/or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.

o. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C

relay output and / or over the serial communication bus.

p. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

7. All VFDs to have the following adjustments:
   a. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
   b. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 mA of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
   c. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (ie. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
   d. Two (2) programmable analog inputs shall accept current or voltage signals.
   e. Two (2) programmable analog outputs (0 to 20 mA or 4 to 20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
   f. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC or 24VAC.
   g. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
   h. Run permissive circuit: There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.
   i. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 to 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications).
   j. Seven (7) programmable preset speeds.
   k. Two independently adjustable accelerate and decelerate ramps with 1 to 1800 seconds adjustable time ramps.
   l. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
   m. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
   n. The VFD shall include password protection against parameter changes.
8. The keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alphanumeric codes are not acceptable). All VFD faults shall be displayed in English words. The

keypad shall include a minimum of 14 assistants including:

a. Start-up assistant
b. Parameter assistants
c. PID assistant
d. Reference assistant
e. I/O assistant
f. Serial communications assistant
g. Option module assistant
h. Panel display assistant
i. Low noise set-up assistant
j. Maintenance assistant
k. Troubleshooting assistant
l. Drive optimizer assistants

9. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
   a. Output Frequency
   b. Motor Speed (RPM, %, or Engineering units)
   c. Motor Current
   d. Motor Torque
   e. Motor Power (kW)
   f. DC Bus Voltage
   g. Output Voltage
10. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
11. Serial Communications:
    a. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
    b. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
       1) Data Sharing – Read Property – B.
       2) Data Sharing – Write Property – B.
       3) Device Management – Dynamic Device Binding (Who-Is; I-Am).
       4) Device Management – Dynamic Object Binding (Who-Has; I-Have).
       5) Device Management – Communication Control – B.
    c. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
    d. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
    e. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO and AO commands in memory in the event

the serial communications connection is lost and continue controlling the process.

12. EMI/RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
13. All VFDs through 75 hp at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.
14. Operational Functions:
    a. The drive shall contain two separate acceleration/deceleration times with auto tuning for optimum setting (0.1 to 6000 seconds) with choice of linear, S, or C curves that shall be factory programmed to match the fan load and prevent nuisance overcurrent fault trips.
    b. The drive shall be equipped with both local/remote and manual/auto keys on touchpad.
    c. The drive shall be equipped with a quick setup key.
    d. The drive shall contain 15 preset speeds, which can be activated from the keypad, terminal inputs, and host computer.
    e. The drive shall have the capability of storable special custom user setting.
    f. The drive shall restart into a rotating motor operating in either the forward or reverse direction and match that frequency.
    g. The drive shall have adjustable soft stall (10% to 150%) which reduces frequency and voltage of the inverter to sustain a run in an overload situation factory programmed for each motor's characteristics.
    h. The drive shall be capable of performing a time base pattern run using 4 groups of 8 patterns each using the 15 preset speed values for a maximum of 32 different patterns.
    i. The drive shall have adjustable UL listed electronic overload protection (10% to 100%) factory programmed to match each motor's FLA/RLA ratings.
    j. The drive shall have a custom programmable volt/hertz pattern.
15. Protective Features:
    a. The drive shall be rated for 200,000 AIC (ampere interrupting capacity). The use of input fuses to achieve this rating shall not be acceptable.
    b. The drive shall have external fault input.
    c. The drive shall be capable of resetting faults remotely and locally.
    d. The drive shall be programmable to alert the following alarms:
        1) Over torque alarm.
        2) Inverter overload pre-alarm.
        3) Motor overload pre-alarm.
        4) Braking resistor overload pre-alarm.
        5) Inverter overheat pre-alarm.
        6) Undercurrent alarm.
        7) Overcurrent pre-alarm.
        8) Communication error alarm.
        9) Cumulative timer alarm.
        10) Executing retry.
    e. The drive shall identify and display the following faults:
        1) Overcurrent during acceleration trip.
        2) Overcurrent during deceleration trip.
        3) Overcurrent during normal run trip.
        4) Overcurrent on the DC Bus during acceleration trip.
        5) Overcurrent on the DC Bus during deceleration trip.
        6) Overcurrent on the DC Bus during normal run trip.
        7) Load end overcurrent trip detected at start-up (output terminals, motor wiring, etc.).
        8) U-phase short circuit trip detected at start-up.
        9) V-phase short circuit trip detected at start-up.
        10) W-phase short circuit trip detected at start-up.
        11) Overvoltage during acceleration trip.
        12) Overvoltage during deceleration trip.
        13) Overvoltage during normal (constant speed) run trip.
        14) Inverter overloaded trip.
        15) Motor overloaded trip.
        16) Inverter overheat trip.
        17) Emergency off trip message.
        18) EEPROM failure during write cycle.
        19) EEPROM abnormality during initial reading.
        20) RAM error.
        21) ROM error.
        22) CPU error.
        23) Communication interruption error.
        24) Gate array error.

25) Output current detection circuit error.
26) Option PCB error trip.
27) Low operating current trip.
28) Main circuit under voltage trip.
29) Over torque trip.
30) Software detected earth fault trip.
31) Hardware detected earth fault trip.
32) Inverter type form mismatch error.
33) EEPROM type form mismatch error.

16. Monitor Functions:
    a. The drive digital display shall be capable of displaying the following: Frequency, percent current, current amps, percent voltage I/O, voltage in volts I/O, RPM, GPM, I/O watts, torque, and input reference signal, kWh.
    b. The drive shall have 320 programmable parameters which can be changed while the drive is operating.
    c. The drive's 353 parameters shall be adjustable from the 8-key touchpad or computer link.
    d. The drive's 8-key touchpad shall be NEMA 12 rated.
    e. The drive's keypad shall be capable of being extended 15 ft from the drive.
    f. The drive shall contain a reset of all parameters to factory default settings or user defaults (whichever one is chosen).
    g. The drive shall have 2 programmable analog outputs programmable to 17 choices.
    h. The drive shall have one programmable relay output programmable to 67 choices.
    i. The drive shall have 8 programmable digital inputs programmable to 54 choices.
    j. The drive shall have a pulse train output proportional to frequency (48, 96, 360 times frequency).
    k. The drive shall have an elapsed time meter.

AHU-1, AHU-2

CH-1

SUBMITTAL

Project

Building 1073

Date

Monday, October 22, 2012

General Contractor

Mechanical Contractor

Mechanical Engineer

Casey Huffaker
Sigler
300 N. Mark Stall
Boise ID 83704

CH-1

Table Of Contents

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

10 Ton **3**
Unit Report 4
Certified Drawing 5
Field Wiring Diagram 6
Acoustic Summary 8

10 Ton

Tag Cover Sheet
Unit Report
Certified Drawing
Wiring Diagram
Performance Report
Acoustic Summary
Detailed Performance Output Report

Unit Report For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

Unit Information

Tag Name:	**10 Ton**	
Model Number:	**30RAP010**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Nameplate Voltage:	**208/230-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R410A**	
Independent Refrigerant Circuits:	**1**	
Capacity Control Steps:	**1**	
Minimum Capacity:	**100.0**	%
Shipping Weight:	**944**	lb
Operating Weight:	**866**	lb
Unit Length:	**67**	in
Unit Width:	**41**	in
Unit Height:	**67**	in

Accessories and Installed Options

Micro Channel, E-Coat
Low Sound
Single Pump, 1.5 HP
Low Ambient Head Pressure Control
Single Point
Chilled Water Storage Tank

Warranty Information (Note: for US & Canada only)

First Year - Parts Only (Standard)

Ordering Information

Part Number	Description	Quantity
30RAP0105F-26000	Packaged Chiller	1
	Base Unit	
	Micro Channel, E-Coat	
	Low Sound	
	Single Pump, 1.5 HP	
	Low Ambient Head Pressure Control	
	Single Point	
30RA-900---050	Chilled Water Storage Tank	1

Certified Drawing for 10 Ton

Project: ~Untitled9
Prepared By: Casey Huffaker

10/22/2012
01:08PM

	UNIT	CENTER OF GRAVITY		UNIT HEIGHT		VICTAULIC CONNECTIONS
		X	Y	H (STANDARD)	H (VALUE SOUND)	WATER IN/OUT
STANDARD	30RA010	18.40 [467]	37.80 [960]	66.5 [1689]	61.0 [1549]	2"
	30RA015	18.35 [466]	37.69 [957]	66.5 [1689]	61.0 [1549]	2"

NOTES:

1. DO NOT CAP OR OTHERWISE OBSTRUCT THE LIQUID LINE TEMPERATURE RELIEF.
2. Ø7/8 [22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
3. Ø0.437 [11.10] HOLE USED FOR MOUNTING UNIT.
4. UNIT MUST HAVE CLEARANCES AS FOLLOWS: TOP - DO NOT RESTRICT. COIL SIDE - 42 [1067] FROM SOLID SURFACE. PANEL SIDE - 48 [1219] PER NEC.
5. SEE TABLE COLUMN H; DIMENSION FOR STANDARD FAN OR VALUE SOUND FAN OPTION.
6. CARRIER DOES NOT RECOMMEND INSTALLATION IN A PIT.
7. UNIT CAN BE HANDLED USING THE FORK TRUCK LIFT POCKETS.
8. WATER CONNECTIONS RECESSED 2-3/8 INCHES INSIDE UNIT.

DIMENSIONS IN [ ] ARE IN MILLIMETERS

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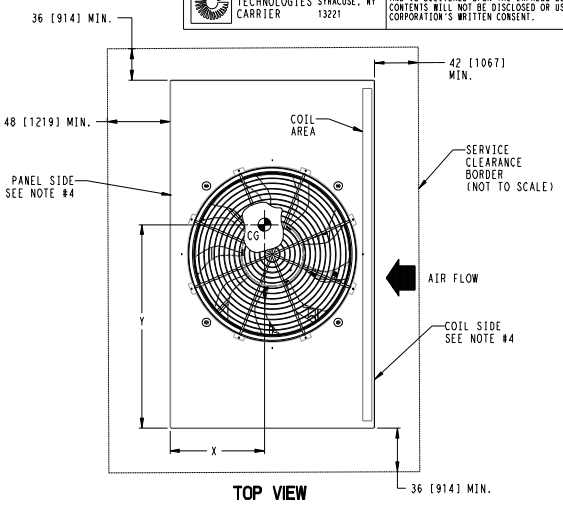
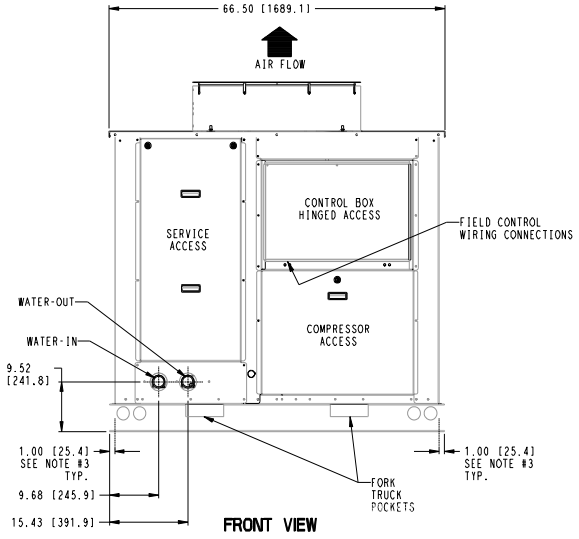
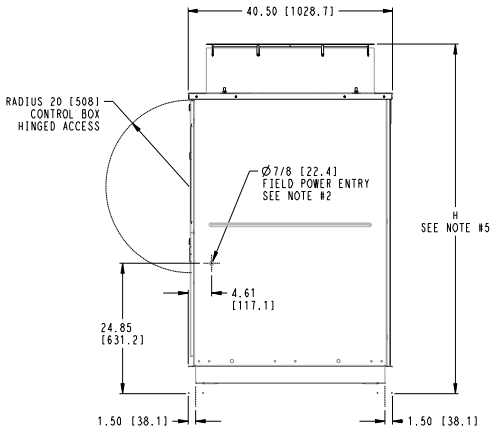


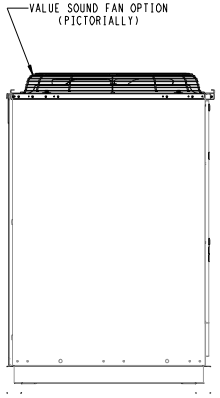
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW

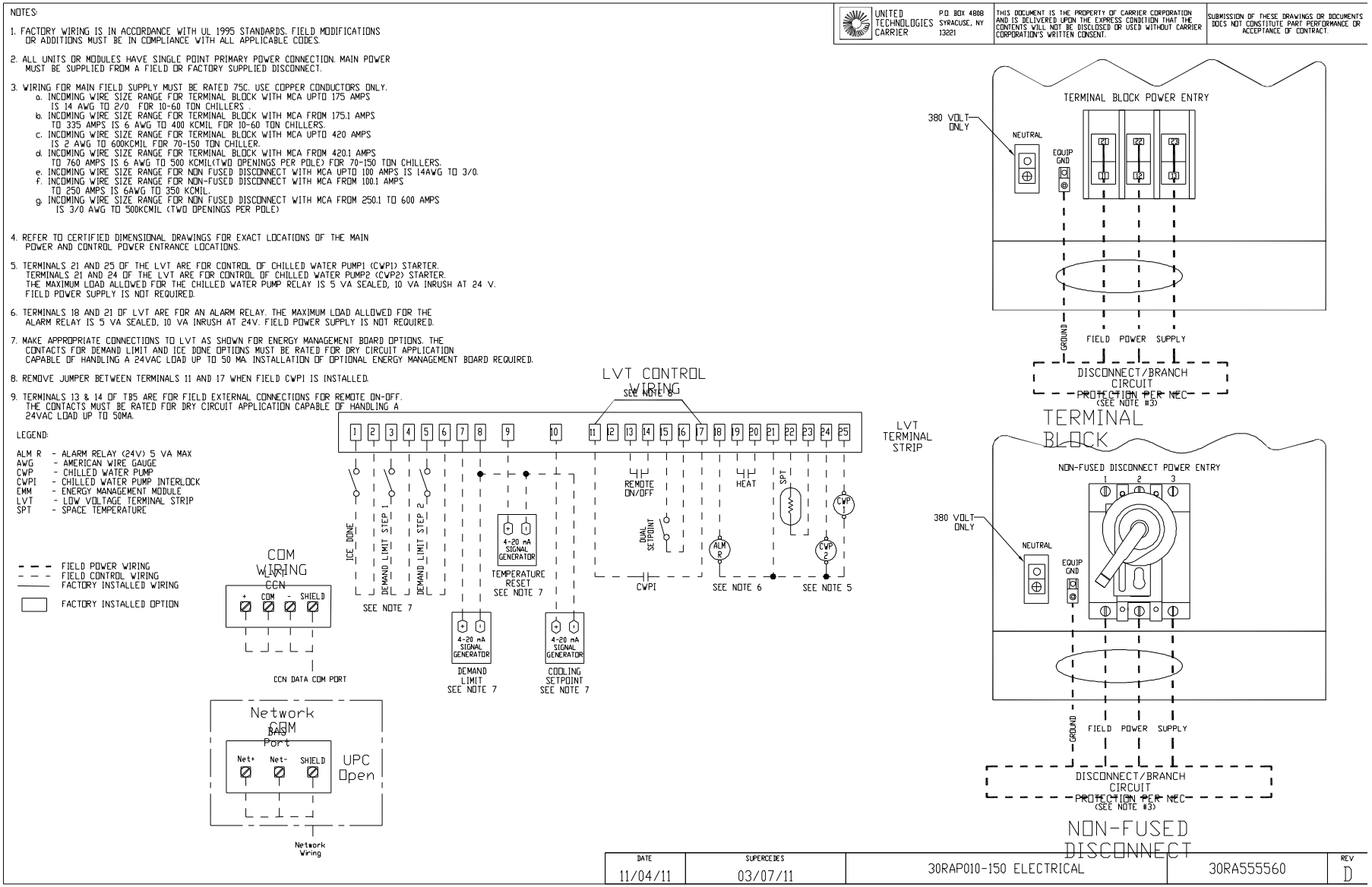


DATE	SUPERCEDES			REV
08/20/09	-	UNIT ASSY	30RA555554	1.5

Field Wiring Diagram for 10 Ton

Project: ~Untitled9
Prepared By: Casey Huffaker

10/22/2012
01:08PM


NOTES:
1. FACTORY WIRING IS IN ACCORDANCE WITH UL 1995 STANDARDS. FIELD MODIFICATIONS OR ADDITIONS MUST BE IN COMPLIANCE WITH ALL APPLICABLE CODES.
2. ALL UNITS OR MODULES HAVE SINGLE POINT PRIMARY POWER CONNECTION. MAIN POWER MUST BE SUPPLIED FROM A FIELD OR FACTORY SUPPLIED DISCONNECT.
3. WIRING FOR MAIN FIELD SUPPLY MUST BE RATED 75C. USE COPPER CONDUCTORS ONLY.
a. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA UPTO 175 AMPS IS 14 AWG TO 2/0 FOR 10-60 TON CHILLERS .
b. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA FROM 175.1 AMPS TO 335 AMPS IS 6 AWG TO 400 KCMIL FOR 10-60 TON CHILLERS.
c. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA UPTO 420 AMPS IS 2 AWG TO 600KCMIL FOR 70-150 TON CHILLER.
d. INCOMING WIRE SIZE RANGE FOR TERMINAL BLOCK WITH MCA FROM 420.1 AMPS TO 760 AMPS IS 6 AWG TO 500 KCMIL(TWO OPENINGS PER POLE) FOR 70-150 TON CHILLERS.
e. INCOMING WIRE SIZE RANGE FOR NON FUSED DISCONNECT WITH MCA UPTO 100 AMPS IS 14AWG TO 3/0.
f. INCOMING WIRE SIZE RANGE FOR NON-FUSED DISCONNECT WITH MCA FROM 100.1 AMPS TO 250 AMPS IS 6AWG TO 350 KCMIL.
g. INCOMING WIRE SIZE RANGE FOR NON FUSED DISCONNECT WITH MCA FROM 250.1 TO 600 AMPS IS 3/0 AWG TO 500KCMIL (TWO OPENINGS PER POLE)
4. REFER TO CERTIFIED DIMENSIONAL DRAWINGS FOR EXACT LOCATIONS OF THE MAIN POWER AND CONTROL POWER ENTRANCE LOCATIONS.
5. TERMINALS 21 AND 25 OF THE LVT ARE FOR CONTROL OF CHILLED WATER PUMP1 (CWP1) STARTER. TERMINALS 21 AND 24 OF THE LVT ARE FOR CONTROL OF CHILLED WATER PUMP2 (CWP2) STARTER. THE MAXIMUM LOAD ALLOWED FOR THE CHILLED WATER PUMP RELAY IS 5 VA SEALED, 10 VA INRUSH AT 24 V. FIELD POWER SUPPLY IS NOT REQUIRED.
6. TERMINALS 18 AND 21 OF LVT ARE FOR AN ALARM RELAY. THE MAXIMUM LOAD ALLOWED FOR THE ALARM RELAY IS 5 VA SEALED, 10 VA INRUSH AT 24V. FIELD POWER SUPPLY IS NOT REQUIRED.
7. MAKE APPROPRIATE CONNECTIONS TO LVT AS SHOWN FOR ENERGY MANAGEMENT BOARD OPTIONS. THE CONTACTS FOR DEMAND LIMIT AND ICE DONE OPTIONS MUST BE RATED FOR DRY CIRCUIT APPLICATION CAPABLE OF HANDLING A 24VAC LOAD UP TO 50 MA. INSTALLATION OF OPTIONAL ENERGY MANAGEMENT BOARD REQUIRED.
8. REMOVE JUMPER BETWEEN TERMINALS 11 AND 17 WHEN FIELD CWP1 IS INSTALLED.
9. TERMINALS 13 & 14 OF TB5 ARE FOR FIELD EXTERNAL CONNECTIONS FOR REMOTE ON-OFF. THE CONTACTS MUST BE RATED FOR DRY CIRCUIT APPLICATION CAPABLE OF HANDLING A 24VAC LOAD UP TO 50MA.
LEGEND:
ALM R - ALARM RELAY (24V) 5 VA MAX
AWG - AMERICAN WIRE GAUGE
CWP - CHILLED WATER PUMP
CWPI - CHILLED WATER PUMP INTERLOCK
EMM - ENERGY MANAGEMENT MODULE
LVT - LOW VOLTAGE TERMINAL STRIP
SPT - SPACE TEMPERATURE
FIELD POWER WIRING
FIELD CONTROL WIRING
FACTORY INSTALLED WIRING
FACTORY INSTALLED OPTION
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LVT CONTROL WIRING
SEE NOTE 8
LVT TERMINAL STRIP
ICE_DONE
DEMAND_LIMIT STEP 1
DEMAND_LIMIT STEP 2
4-20 mA SIGNAL GENERATOR
TEMPERATURE RESET
SEE NOTE 7
REMOTE ON/OFF
DUAL SETPOINT
CWPI
HEAT
ALM R
SPT
CWP 1
CWP 2
SEE NOTE 6
SEE NOTE 5
SEE NOTE 7
DEMAND LIMIT
SEE NOTE 7
COOLING SETPOINT
SEE NOTE 7
COM WIRING
CCN
+ COM - SHIELD
CCN DATA COM PORT
Network COM Port
BAS
Net+ Net- SHIELD
UPC Open
Network Wiring
TERMINAL BLOCK POWER ENTRY
380 VOLT ONLY
NEUTRAL
EQUIP GND
GROUND
FIELD POWER SUPPLY
DISCONNECT/BRANCH CIRCUIT PROTECTION PER NEC
(SEE NOTE #3)
TERMINAL BLOCK
NON-FUSED DISCONNECT POWER ENTRY
380 VOLT ONLY
NEUTRAL
EQUIP GND
GROUND
FIELD POWER SUPPLY
DISCONNECT/BRANCH CIRCUIT PROTECTION PER NEC
(SEE NOTE #3)
NON-FUSED DISCONNECT
DATE 11/04/11
SUPERCEDES 03/07/11
30RAP010-150 ELECTRICAL
30RA555560
REV D

Summary Performance Report For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

AquaSnap™ Air-Cooled Scroll Chiller Scroll Chiller with Remote Condenser

Unit Information

Tag Name:	**10 Ton**	
Model Number:	**30RAP010**	
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R410A**	
Independent Refrigerant Circuits:	**1**	
Shipping Weight:	**944**	lb
Operating Weight:	**866**	lb
Unit Length:	**67**	in
Unit Width:	**41**	in
Unit Height:	**67**	in

Evaporator Information

Fluid Type:	**Fresh Water**	
Fouling Factor:	**0.00010**	(hr-sqft-F)/BTU
Leaving Temperature:	**45.0**	°F
Entering Temperature:	**56.3**	°F
Fluid Flow:	**24.0**	gpm
Pressure Drop:	**16.0**	ft

Condenser Information

Altitude:	**0**	ft
Number of Fans:	**1**	
Total Condenser Fan Air Flow:	**9400**	CFM
Entering Air Temperature:	**84.0**	°F

Integrated Pump Information

Dynamic Head At Pump:	**58.5**	ft
Internal Chiller Head Loss:	**16.0**	ft
Dynamic Head External To Chiller:	**42.5**	ft

Performance Information

Cooling Capacity:	**11.3**	Tons
Total Compressor Power:	**9.63**	kW
Total Fan Motor Power:	**1.21**	kW
Pump Power:	**0.89**	kW
Total Unit Power (without pump):	**10.8**	kW
Total Unit Power (with pump):	**11.7**	kW
Efficiency (without pump):	**12.53**	EER
IPLV:	**14.15**	EER
A-Weighted Sound Power Level:	**87**	dbA

Accessories and Installed Options

Micro Channel, E-Coat
Low Sound
Single Pump, 1.5 HP
Low Ambient Head Pressure Control
Single Point
Chilled Water Storage Tank

Electrical Information

Unit Voltage: **208/230-3-60** V-Ph-Hz
Connection Type: **Single Point**

Amps	Electrical Circuit 1	Electrical Circuit 2
MCA	70.4	---
MOCP	110.0	---
ICF	255.3	---

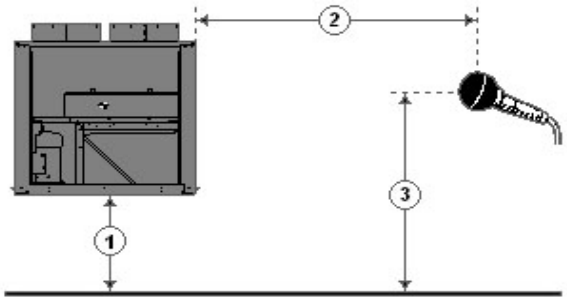
All performance efficiency data are without pump.
Note: Weights and electrical values do not include separately shipped accessories.
Certified in accordance with the AHRI Air-Cooled Water Chilling Packages Using Vapor Compression Cycle Certification Program, which is based on AHRI Standard 550/590 (I-P). Certified units may be found in the AHRI Directory at www.ahridirectory.org.
Sound power measured in accordance with ANSI/AHRI Standard 370-2001.

Acoustic Summary For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

Unit Parameters

Tag Name:	**10 Ton**	
Model Number:	**30RAP010**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Chiller Nameplate Voltage:	**208/230-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R410A**	
Shipping Weight:	**944**	lb
Operating Weight:	**866**	lb
Unit Length:	**67**	in
Unit Width:	**41**	in
Unit Height:	**67**	in



1 - Chiller Height Above Ground
2 - Horizontal Distance From Chiller to Receiver
3 - Receiver Height Above Ground

Accessories and Installed Options

Micro Channel, E-Coat
Low Sound
Single Pump, 1.5 HP
Low Ambient Head Pressure Control
Single Point
Chilled Water Storage Tank

Acoustic Information (Full Load)

Octave Band Center Frequency, Hz	31	63	125	250	500	1k	2k	4k	8k	Total
Sound pressure at specified distance in a free field, dB	46	50	55	52	53	50	47	42	34	60
A-Weighted Sound Pressure Level, dBA	6	24	39	44	50	50	48	43	33	55
Sound Power at Chiller Acoustic Center, dB	78	82	87	84	85	81	79	74	66	92
A-Weighted Sound Power, dBA	38	56	71	76	82	81	80	75	64	87

Notes

1 - Chiller Height Above Ground = 0.0 ft
2 - Horizontal Distance From Chiller to Receiver = 50.0 ft
3 - Receiver Height Above Ground = 0.0 ft
Estimated Sound Power levels - dB re: 1 picowatt
Estimated Sound Pressure levels - dB re: 20 micropascal
Estimated sound levels given above are assumed to originate at the acoustic center of the chiller.

Sound pressure level data used to develop this program was determined in accordance with AHRI Standard 575 for water chillers in a free field and ANSI/AHRI Standard 370 for air cooled chillers.

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.

Detailed Performance Summary For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

Unit Information

Tag Name:	**10 Ton**	
Model Number:	**30RAP010**	
Condenser Type:	**Air Cooled**	
Compressor Type:	**Scroll**	
Nameplate Voltage:	**208/230-3-60**	V-Ph-Hz
Quantity:	**1**	
Manufacturing Source:	**Charlotte, NC USA**	
Refrigerant:	**R410A**	
Capacity Control Steps:	**1**	
Minimum Capacity:	**100.0**	%
Shipping Weight:	**944**	lb
Operating Weight:	**866**	lb
Unit Length:	**67**	in
Unit Width:	**41**	in
Unit Height:	**67**	in
Minimum Outdoor Operating Temp:	**-20**	°F

Performance Information

Cooling Capacity:	**11.3**	Tons
Total Compressor Power:	**9.63**	kW
Total Fan Motor Power:	**1.21**	kW
Pump Power:	**0.89**	kW
Total Unit Power (without pump):	**10.8**	kW
Total Unit Power (with pump):	**11.7**	kW
Efficiency (without pump):	**12.53**	EER

Acoustics Information

A-Weighted Sound Power Level:	**87**	dbA

Evaporator Information

Fluid Type:	**Fresh Water**	
Fouling Factor:	**0.00010**	(hr-sqft-F)/BTU
Leaving Temperature:	**45.0**	°F
Entering Temperature:	**56.3**	°F
Fluid Flow:	**24.0**	gpm
Pressure Drop:	**16.0**	ft

Condenser Information

Altitude:	**0**	ft
Number of Fans:	**1**	
Total Condenser Fan Air Flow:	**9400**	CFM
Entering Air Temperature:	**84.0**	°F

Electrical Information

Unit Voltage:	**208/230-3-60**	V-Ph-Hz
Connection Type:	**Single Point**	

Amps	Electrical Circuit 1	Electrical Circuit 2
MCA	70.4	
MOCP	110.0	
ICF	255.3	

Integrated Pump Information

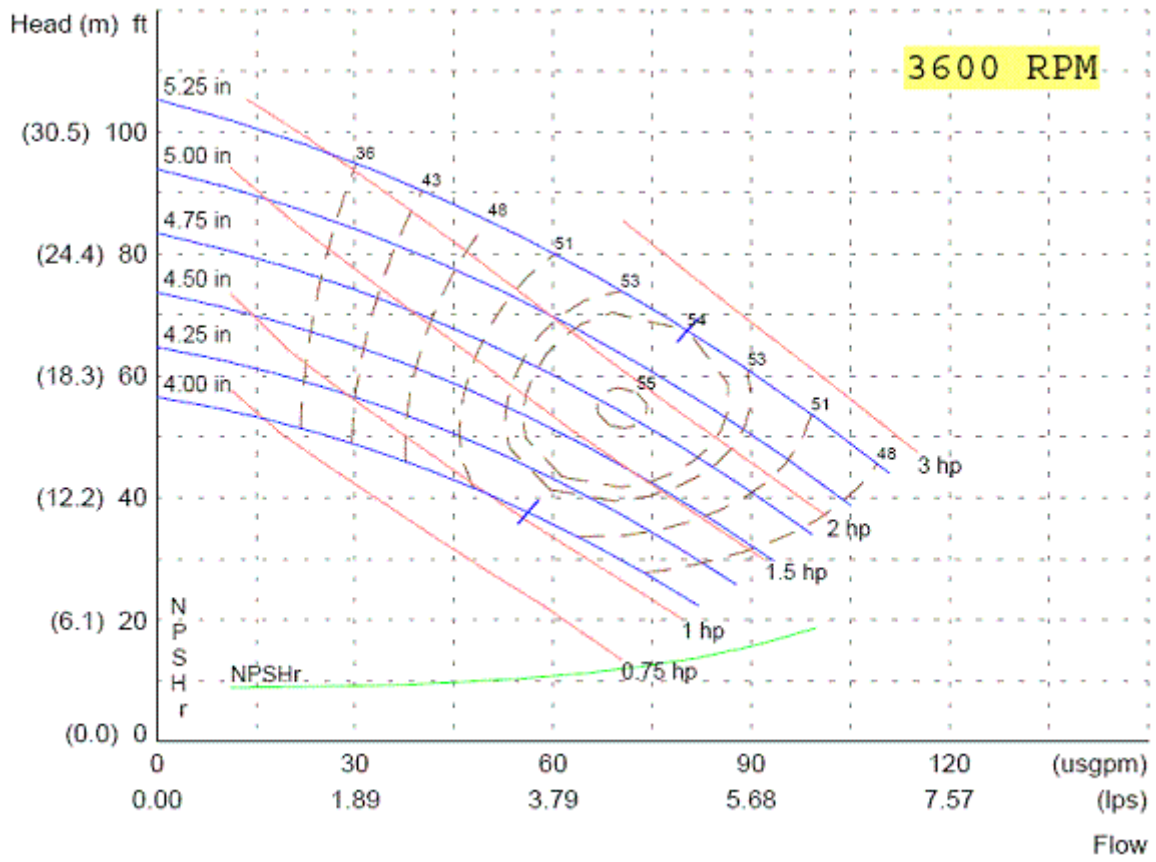
Dynamic Head At Pump:	**58.5**	ft
Internal Chiller Head Loss:	**16.0**	ft

CH-1

Detailed Performance Summary For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

Dynamic Head External To Chiller: **42.5** ft



Accessories and Installed Options

Micro Channel, E-Coat
Low Sound
Single Pump, 1.5 HP
Low Ambient Head Pressure Control
Single Point
Chilled Water Storage Tank

Integrated Part Load Value (ARI)

IPLV: **14.15** EER

Unit Performance				
Percent of Full Load Capacity, %	100	75	50	25
Percent of Full Load Power, %	100.0	62.0	34.7	15.8
Unloading Sequence	A	A	A	A
Cooling Capacity, Tons	10.4	7.8	5.2	2.6
Total Unit Power, kW	12.0	7.4	4.2	1.9
Efficiency, EER	10.42	12.61	15.03	16.51
Evaporator Data				
Fluid Entering Temperature, °F	54.0	51.5	49.0	46.5
Fluid Leaving Temperature, °F	44.0	44.0	44.0	44.0
Fluid Flow Rate, gpm	25.0	25.0	25.0	25.0
Fouling Factor, (hr-sqft-F)/BTU	0.0001	0.0001	0.0001	0.0001

Detailed Performance Summary For 10 Ton

Project: ~Untitled9 10/22/2012
Prepared By: Casey Huffaker 01:08PM

Condenser Data				
Entering Air Temperature, °F	95.0	80.0	65.0	55.0

For some 75% operating points, the efficiency may be calculated at a condenser inlet air operating temperature as much as 0.8 degrees higher.

Load Line

Unit Performance				
Percent Full Load Capacity, %	100.0	90.0	85.0	80.0
Percent of Full Load Power, %	100.0	86.2	79.7	73.5
Unloading Sequence	A	A	A	A
Capacity, Tons	11.3	10.2	9.6	9.1
Total Unit Power, kW	10.8	9.3	8.6	8.0
Efficiency, EER	12.53	13.08	13.36	13.64
Evaporator Data				
Fluid Entering Temperature, °F	56.3	55.1	54.6	54.0
Fluid Leaving Temperature, °F	45.0	45.0	45.0	45.0
Fluid Flow Rate, gpm	24.0	24.0	24.0	24.0
Fouling Factor, (hr-sqft-F)/BTU	0.00010	0.00010	0.00010	0.00010
Condenser Data				
Entering Air Temperature, °F	84.0	81.1	79.7	78.2

All performance efficiency data are without pump.
Note: Weights and electrical values do not include separately shipped accessories.
Certified in accordance with the AHRI Air-Cooled Water Chilling Packages Using Vapor Compression Cycle Certification Program, which is based on AHRI Standard 550/590 (I-P). Certified units may be found in the AHRI Directory at www.ahridirectory.org.
Sound power measured in accordance with ANSI/AHRI 370-2001.

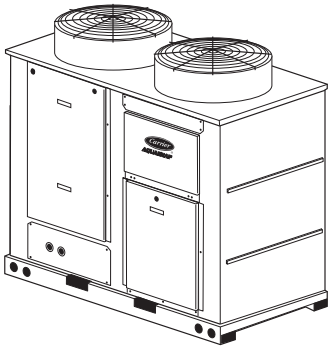
Carrier®

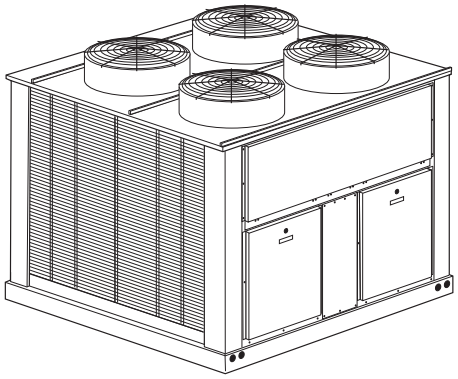
Product Data

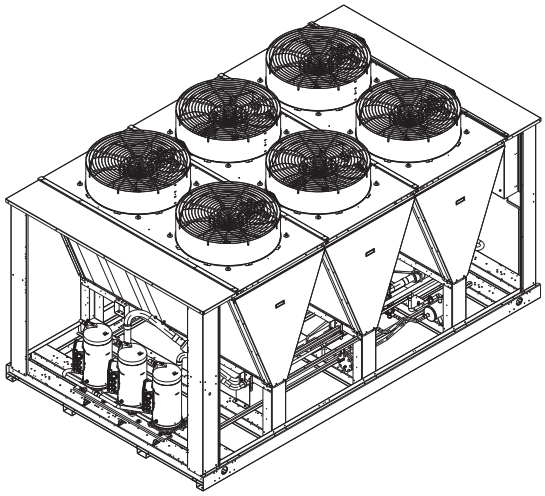
AQUASNAP® 30RAP010-090 Air-Cooled Chillers with PURON® Refrigerant (R-410A)

10 to 90 Nominal Tons
(35 to 316 Nominal kW)

AQUASNAP®







Puron®
the environmentally sound refrigerant

ASHRAE 90.1 COMPLIANT

The AquaSnap chiller is an effective all-in-one package that is easy to install and easy to own. AquaSnap chillers operate quietly and efficiently. Value-added features include:

- Rotary scroll compression
- HFC Puron® refrigerant (R-410A)
- Low-sound AeroAcoustic™ fan system
- Easy to use *Comfort*Link controls
- Optional integrated hydronic pump package with VFD (variable frequency drive) compatible motors, with optional VFD on 070-090 models
- Microchannel condenser coil technology
- Accessory fluid storage tank on 010 - 060 models
- Optional digital scroll compressors

Features/Benefits

Carrier's superior chiller design provides savings at initial purchase, at installation, and for years afterward.

Costs less right from the start

Carrier's AquaSnap chillers feature a compact, all-in-one package design that installs quickly and easily on the ground or the rooftop. The optional pump and hydronic components are already built in; this costs less than buying and installing the components individually. The chiller's fully integrated and pre-assembled hydronic system installs in minutes. No other chiller in this class installs so easily and inexpensively. The preassembled and integrated hydronic module utilizes top-quality components and pumps to ensure years of reliable operation.

Use of the optional fluid storage tank, available on size 010-060 models, reduces installation costs and ensures sufficient fluid volume is available for close-coupled and process cooling applications. The AquaSnap unit's high efficiency keeps costs down.

Copyright 2012 Carrier Corporation

Features/Benefits (cont)

AquaSnap® chillers make noise in the marketplace, not the workplace.

The AquaSnap chiller's low-sound AeroAcoustic™ fan produces up to half the sound level of propeller fans. Much of the noise reduction is in frequencies where noise is most annoying, which makes AquaSnap chillers ideal for sound-sensitive environments. When lower ambient temperatures allow part load operation or during scheduled nighttime operation, the units operate with fewer fans and become even quieter. AquaSnap chillers are quiet during the day and even quieter at night.

The savings will continue to mount

Besides costing less to buy and install, AquaSnap chillers are also more affordable to operate. Carrier's Aqua Series chillers are our most efficient air-cooled models. The AquaSnap chiller provides full load EER (Energy Efficiency Ratio) up to 10.5 and IPLV (integrated part load value) up to 15.9. AquaSnap chillers use ultra-quiet, high-efficiency rotary scroll compressors, operated in single (sizes 010 and 015) tandem (sizes 018 to 060), and tandem or trio (sizes 070 to 090) per independent circuit for greater efficiency at partial loads.

Electronic expansion valve (EXV) allows for precise control through all operating ranges, resulting in higher efficiency and improved reliability.

Proven reliability that's built in

Thousands of AquaSnap chillers are already in service around the world. This field-proven design is backed by a 12-month warranty that includes the hydronic system. The compressors are maintenance-free and protected by an auto-adaptive control that minimizes compressor wear. Unit sizes 035 and up have two independent refrigerant circuits. Year-round operation is standard, from –20 F (–29 C) (with optional cooler heater, low ambient control, and wind baffles) to 120 F (50 C).

Rotary scroll compressors provide smooth, quiet and reliable operation.

All-in-one package

AquaSnap chillers provide the most comprehensive chilled water circuit available for any air-cooled chiller. Included is a brazed plate direct expansion cooler that may be remote-mounted. The cooler is also completely drainable with factory-installed vents and drains.

Electronic thermal-dispersion flow switch is included with the cooler. The switch is factory installed and tested and contains no moving parts for high reliability.

Optional integrated hydronics package is more than just a pump, it is an entire chilled water system, including:

- Single/dual pumps up to 15 hp and 160 ft head
- Regular strainer
- Cleanout strainer
- Flow regulator
- Freeze protection to –20 F (–29 C) (with freeze protection option)
- Heaters
- Required piping
- Pressure/temperature taps
- Isolation valves for dual pump systems
- VFD available on sizes 070 to 090, and VFD compatibility on all models

The factory-installed and tested hydronics package provides faster, simpler and less expensive installation.

Digital scroll compressors are available as a factory-installed option. These allow for incremental unloading with capacity modulation to better match building load when compared to standard scroll compressors.

Environmentally sound

Carrier's Puron® refrigerant (R-410A) enables you to make a responsible decision in the protection of the earth's ozone layer. Puron refrigerant is an HFC refrigerant that does not contain chlorine that is damaging to the ozone layer. Puron refrigerant is unaffected by the Montreal Protocol. Puron refrigerant is a safe, non-toxic*, efficient and environmentally sound refrigerant for the future.

Durable construction

The 30RAP chillers have a structurally sound base that can be point-loaded, therefore, no perimeter base rail is required. All 30RAP units have weatherized cabinets constructed of heavy-duty galvanized steel with exterior panels painted with corrosion-resistant baked enamel. Inside and outside surfaces are protected to ensure long life and good appearance. The durable, galvanized steel, painted components exceed the requirements of the 500-hour salt spray test per ASTM (American Society for Testing and Materials) B117.

*Comfort*Link controls speak your language

The *Comfort*Link controls communicate in plain English, making it as easy as possible to monitor and control each AquaSnap chiller while accurately maintaining fluid temperatures. The large scrolling marquee display acts as a window into the unit's operation, providing easy-to-read information about chiller performance and over 15 diagnostic functions. Carrier 30 Series chillers' *Comfort*Link controls provide features such as chilled water temperature reset, demand limiting, compressor wear minimization and protection, temperature and pressure displays and diagnostic functions.

Table of contents

	Page
Features/Benefits	1-3
Model Number Nomenclature	4
AHRI Capacity Ratings	5
Physical Data	6-8
Options and Accessories	9,10
Base Unit Dimensions	11-14
Accessory Dimensions	15-17
Selection Procedure	18
Performance Data	19-40
Typical Piping and Wiring	41-44
Electrical Data	45-56
Controls	57-59
Typical Control Wiring Schematic	60
Application Data	61-68
Guide Specifications	69-74

These controls result in higher chiller reliability, simplified training and more productive service calls with correspondingly lower operational and maintenance costs.

Carrier's exclusive accessory handheld Navigator™ display provides convenience and powerful information in the palm of your hand. The Navigator display helps technicians to quickly diagnose problems and even prevent them from occurring.

All AquaSnap units are ready to be used with the Carrier Comfort Network® (CCN) system.

A BACnet† communication option is also available for the i-Vu® Open control system or a BACnet building automation system.

AquaSnap units minimize the impact on your footprint, as well as your bottom line

The integrated hydronics and the chilled fluid storage tank's placement under the chiller minimize the footprint, allowing easy installation almost anywhere.

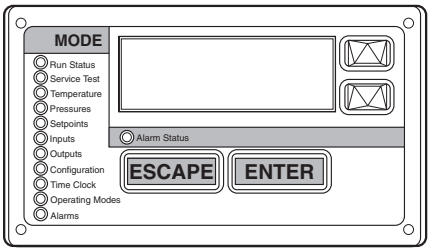
Novation® heat exchanger technology

The Novation heat exchanger design with microchannel (MCHX) condenser coil is a robust, cost effective alternative to traditional coil design. These coils are offered coated or uncoated to match coil protection to site conditions. The Carrier Electronic Catalog (E-Cat) can be used to determine whether or not corrosion protection is recommended for particular applications in coastal/marine environments. Following the input of the requested data, the E-Cat program output will advise the appropriate coil to be used. Other factors described in "Selection Guide: Environmental Corrosion Protection, Novation Heat Exchanger with Microchannel Coil Technology" catalog number 04-581042-01 must also be considered to determine if corrosion protection is required.

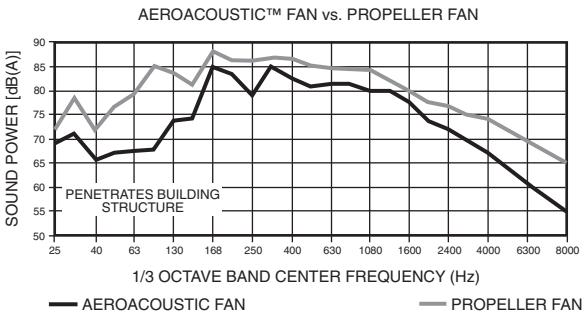
Microchannel coils are more robust than other coil types, making them easier to clean without causing damage to the coil.

Due to the compact all aluminum design, microchannel coils will reduce average unit operating weight by 25% compared to the previous 30RA units. The streamlined MCHX coil design also reduces refrigerant charge by an average of 60% compared to previous 30RA units.

* Under ASHRAE Standard 34-1992, R-410A is classified as an A1 refrigerant.
† Sponsored by ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers).

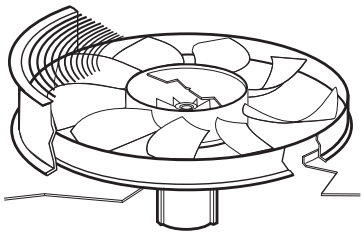


SCROLLING MARQUEE DISPLAY

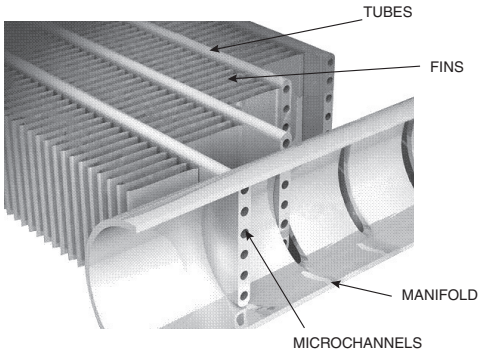


AEROACOUSTIC FAN VS PROPELLER FAN

NAVIGATOR™ DISPLAY MODULE



LOW-SOUND AEROACOUSTIC FAN WITH NIGHTTIME LOW



NOVATION® HEAT EXCHANGER TECHNOLOGY WITH MICROCHANNEL CONDENSER COILS

CH-1

Model number nomenclature

AQUASNAP® CHILLER MODEL NUMBER DESIGNATION

30RA P 010 6 D A 0 6 0 0 0

30RA – Air-Cooled AquaSnap Chiller

Refrigerant Type
P – Puron®

Unit Sizes
010 025 045 070
015 030 050 080
018 035 055 090
020 040 060

Voltage
1 – 575-3-60
2 – 380-3-60
5 – 208/230-3-60
6 – 460-3-60

Condenser Coil/Low Sound Options
5 – MCHX, Value Sound Fan
6 – MCHX, E-coat, Value Sound Fan
D – MCHX, AeroAcoustic™ Fan
F – MCHX, E-coat, AeroAcoustic Fan
J – MCHX, AeroAcoustic Fan, Compressor Blanket(s)
K – MCHX, E-coat, AeroAcoustic Fan, Compressor Blanket(s)

Revision Level
A – Current Revision Level

Hydronic System

30RAP010-060
0 – No Pump
2 – Single Pump, 1.5 Hp
3 – Single Pump, 3 Hp
4 – Single Pump, 3 Hp High Head
5 – Single Pump, 5 Hp
6 – Single Pump, 5 Hp High Head
7 – Single Pump, 7.5 Hp
Z – Single Pump, 10 Hp
9 – Dual Pump, 1.5 Hp
B – Dual Pump, 3 Hp
C – Dual Pump, 3 Hp High Head
D – Dual Pump, 5 Hp
F – Dual Pump, 5 Hp High Head
G – Dual Pump, 7.5 Hp
H – Dual Pump, 10 Hp

30RAP070-090
0 – No Pump
1 – Single Pump, 3 Hp
2 – Single Pump, 5 Hp
3 – Single Pump, 7.5 Hp
4 – Single Pump, 10 Hp
5 – Single Pump, 15 Hp
6 – Dual Pump, 3 Hp
7 – Dual Pump, 5 Hp
8 – Dual Pump, 7.5 Hp
9 – Dual Pump, 10 Hp
B – Dual Pump, 15 Hp
C – Single Pump, 3 Hp with VFD
D – Single Pump, 5 Hp with VFD
F – Single Pump, 7.5 Hp with VFD
G – Single Pump, 10 Hp with VFD
H – Single Pump, 15 Hp with VFD
J – Dual Pump, 3 Hp with VFD
K – Dual Pump, 5 Hp with VFD
L – Dual Pump, 7.5 Hp with VFD
M – Dual Pump, 10 Hp with VFD
N – Dual Pump, 15 Hp with VFD

Packaging/Security Options
0 – Std Packaging
4 – Security Grilles/Hail Guards Only
8 – Skid Only
D – Skid, Security Grilles/Hail Guards
J – Skid, Top Crate, Bag
N – Skid, Top Crate, Bag, Security Grilles/Hail Guards

Controls/Communications Options
0 – Std
1 – Std, BACnet Communication
5 – EMM
6 – EMM, BACnet Communication
B – EMM, GFI
C – EMM, GFI, BACnet Communication
H – GFI
J – GFI, BACnet Communication

Electrical Options

30RAP010-060
0 – No Disconnect, No Cooler Heater
1 – No Disconnect, Cooler Heater
D – Non-Fused Disconnect, No Cooler Heater
F – Non-Fused Disconnect, Cooler Heater

30RAP070-090
0 – Single Point, No Disconnect, No Cooler Heater
1 – Single Point, No Disconnect, Cooler Heater
2 – Single Point, Non-Fused Disconnect, No Cooler Heater
3 – Single Point, Non-Fused Disconnect, Cooler Heater
4 – Dual Point, No Disconnect, No Cooler Heater
5 – Dual Point, No Disconnect, Cooler Heater

Ambient/Capacity Control/Interrupt Options
0 – Std Comp, Std Interrupt
1 – Hot Gas Bypass, Std Interrupt
2 – Digital Comp, Std Interrupt
3 – Std Comp, High Interrupt
4 – Hot Gas Bypass, High Interrupt
5 – Digital Comp, High Interrupt
6 – Low Ambient, Std Comp, Std Interrupt
7 – Low Ambient, Hot Gas Bypass, Std Interrupt
8 – Low Ambient, Digital Comp, Std Interrupt
9 – Low Ambient, Std Comp, High Interrupt
B – Low Ambient, Hot Gas Bypass, High Interrupt
C – Low Ambient, Digital Comp, High Interrupt
D – Std Comp, Std Interrupt, Suction Service Valve
F – Hot Gas Bypass, Std Interrupt, Suction Service Valve
G – Digital Comp, Std Interrupt, Suction Service Valve
H – Std Comp, High Interrupt, Suction Service Valve
J – Hot Gas Bypass, High Interrupt, Suction Service Valve
K – Digital Comp, High Interrupt, Suction Service Valve
L – Low Ambient, Std Comp, Std Interrupt, Suction Service Valves
M – Low Ambient, Hot Gas Bypass, Std Interrupt, Suction Service Valves
N – Low Ambient, Digital Comp, Std Interrupt, Suction Service Valves
P – Low Ambient, Std Comp, High Interrupt, Suction Service Valves
Q – Low Ambient, Hot Gas Bypass, High Interrupt, Suction Service Valves
R – Low Ambient, Digital Comp, High Interrupt, Suction Service Valves

LEGEND

EMM — Energy Management Module
GFI — Ground Fault Interrupting
MCHX — Microchannel Heat Exchanger
VFD — Variable Frequency Drive

Quality Assurance

Certified to ISO 9001

CH-1

AHRI* capacity ratings

UNIT 30RAP	CAPACITY		COMPRESSOR POWER INPUT (kW)	FAN POWER (kW)	TOTAL POWER (kW)	FULL LOAD		IPLV		COOLER FLOW RATE		COOLER WATER PRESSURE DROP	
	Tons	kW				EER	COP	EER	COP	GPM	L/s	Ft wg	kPa
010	10.5	36.8	10.7	1.2	12.0	10.5	3.1	14.2	4.2	25.1	1.6	13.7	40.9
015	14.0	49.2	15.6	1.3	16.8	10.0	2.9	13.2	3.9	33.5	2.1	15.7	46.8
018	16.1	56.6	15.6	3.0	18.6	10.4	3.0	14.5	4.2	38.6	2.4	15.6	46.5
020	18.8	66.1	19.1	2.9	21.9	10.3	3.0	14.5	4.2	45.2	2.9	14.2	42.4
025	23.4	82.3	24.5	2.8	27.4	10.3	3.0	15.3	4.5	56.3	3.6	17.8	53.1
030	27.6	97.1	30.9	2.7	33.6	9.9	2.9	14.8	4.3	66.3	4.2	20.9	62.3
035	34.4	121.0	35.9	3.8	39.7	10.4	3.0	14.9	4.4	82.5	5.2	13.2	39.4
040	38.9	136.8	42.3	3.8	46.1	10.1	3.0	15.3	4.5	93.4	5.9	13.8	41.2
045	43.1	151.6	48.6	3.4	52.0	10.0	2.9	15.3	4.5	103.4	6.5	15.3	45.6
050	47.3	166.3	53.1	3.8	57.0	10.0	2.9	14.7	4.3	113.5	7.2	19.1	57.0
055	51.8	182.2	56.4	5.3	61.7	10.1	3.0	14.6	4.3	124.2	7.8	17.6	52.5
060	56.0	196.9	60.8	5.3	66.2	10.2	3.0	14.5	4.2	134.4	8.5	20.5	61.2
070	68.9	242.3	74.6	6.8	81.4	10.2	3.0	15.2	4.5	165.2	10.4	19.5	59.4
080	77.4	272.2	83.2	6.7	89.9	10.3	3.0	15.5	4.5	185.9	11.7	21.2	52.5
090	84.0	295.4	91.0	6.8	97.8	10.3	3.0	15.9	4.7	201.7	12.7	22.7	65.6

LEGEND

COP — Coefficient of Performance
EER — Energy Efficiency Ratio
IPLV — Integrated Part Load Value

* Air Conditioning, Heating, and Refrigeration Institute.
NOTE: Based on AHRI-550/590 standard rating conditions. Ratings are for standard chillers only. Ratings do not include options.

AHRI CERTIFIED™
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Air-Cooled Chillers
AHRI Standard 550/590
C

CH-1

Physical data

ENGLISH

UNIT 30RAP	010	015	018	020	025	030	035	040	045	050	055	060	070	080	090
OPERATING WEIGHT (lb)															
MCHX Condenser Coil, No Pump	704	718	1125	1133	1242	1283	2163	2185	2238	2263	2369	2375	3410	3641	3697
MCHX Condenser Coil, Single Pump	866	880	1288	1296	1405	1446	2507	2529	2582	2606	2713	2719	3812	4035	4061
MCHX Condenser Coil, Dual Pump	1029	1043	1450	1458	1567	1608	2850	2872	2925	2950	3056	3062	4092	4390	4411
REFRIGERANT TYPE	R-410A, EXV Controlled System														
Total Refrigerant Charge (lb)	8.6	9.6	14.6	15.2	16.7	17.6	29.2	29.9	33.5	33.7	34.3	34.5	60.5	70.2	71.0
Refrigerant Charge (lb) Ckt A/Ckt B	8.6/—	9.6/—	14.6/—	15.2/—	16.7/—	17.6/—	14.3/ 14.9	14.9/ 15.0	16.5/ 17.0	16.7/ 17.0	16.9/ 17.4	17.1/ 17.4	25.5/35	35.1/ 35.1	35.5/ 35.5
COMPRESSORS	Scroll, Hermetic														
Quantity	1	1	2	2	2	2	4	4	4	4	4	4	5	6	6
Speed (Rpm)	3500														
(Qty, Tons) Ckt A	(1) 11	(1) 15	(2) 9	(2) 10	(2) 13	(2) 15	(2) 10	(2) 10	(2) 11	(2) 13	(2) 13	(2) 15	(2) 15	(3) 13	(3) 15
(Qty, Tons) Ckt B	—	—	—	—	—	—	(2) 9	(2) 11	(2) 13	(2) 13	(2) 15	(2) 15	(3) 15	(3) 15	(3) 15
Oil Charge (Pt) Ckt A/Ckt B	6.9/—	6.9/—	13.8/—	13.8/—	13.8/—	13.8/—	13.8/ 13.8	13.8/ 13.8	13.8/ 13.8	13.8/ 13.8	13.8/ 13.8	13.8/ 13.8	13.8/ 20.6	20.6/ 20.6	20.6/ 20.6
No. Capacity Steps															
Standard	1	1	2	2	2	2	4	4	4	4	4	4	5	6	6
With Hot Gas Bypass	—	—	3	3	3	3	5	5	5	5	5	5	6	7	7
Digital Compressor Option	13	13	22	22	22	22	44	44	44	44	44	44	55	66	66
Minimum Capacity Step (%)															
Standard	100	100	50	50	50	50	23	23	24	25	23	25	20	15	17
With Hot Gas Bypass	—	—	20	24	29	32	9	11	12	14	13	16	13	9	11
Digital Compressor Option	20	20	17	15	15	15	8	8	8	8	8	8	6	5	5
Capacity (%)															
Circuit A	100	100	100	100	100	100	54	47	47	50	46	50	40	46	50
Circuit B	—	—	—	—	—	—	46	53	53	50	54	50	60	54	50
COOLER	Brazed, Direct-Expansion Plate Heat Exchanger														
Weight (lb) (empty)	22.4	27.5	31.8	40.3	46.3	80.6	99.4	117.9	125.3	137.5	160.4	160.4	197	228	245
Net Fluid Volume (gal)	0.6	0.8	0.9	1.2	1.4	2.0	2.6	3.3	3.5	4.1	5.0	5.0	4.3	5.0	6.8
Maximum Refrigerant Pressure (psig)	505	505	505	505	505	565	565	565	565	565	565	565	450	450	450
Maximum Water-Side Pressure Without Pump(s) (psig)	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Maximum Water-Side Pressure With Pump(s) (psig)	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
CHILLER WATER CONNECTIONS (in.)															
Inlet and Outlet, Victaulic (IPS Carbon Steel)*	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	3	3	3
Drain (NPT)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
CONDENSER FANS															
Standard Low-Sound AeroAcoustic™ Type	Plastic Type, Axial, Vertical Discharge														
Fan Speed (Rpm)	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
No. Blades...Diameter (in.)	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30
No. Fans	1	1	2	2	2	2	3	3	3	3	4	4	5	6	6
Total Airflow (Cfm)	9400	9400	17,500	17,500	19,400	19,400	29,600	29,600	30,500	30,500	38,800	38,800	48,500	58,200	58,200
Optional Value Sound Type	Propeller Type, Axial, Vertical Discharge														
Fan Speed (Rpm)	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
No. Blades...Diameter (in.)	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30	4...30
No. Fans	1	1	2	2	2	2	3	3	3	3	4	4	5	6	6
Total Airflow (Cfm)	10,100	10,100	18,500	18,500	20,900	20,900	32,000	32,000	33,300	33,300	41,800	41,800	51,250	61,500	61,500
CONDENSER COILS	Novation® MCHX Aluminum Tube, Aluminum Fin														
Quantity (Ckt A/Ckt B)	1/—	1/—	1/—	1/—	1/—	1/—	1/1	1/1	1/1	1/1	1/1	1/1	2/3	3/3	3/3
Total Face Area (sq ft)	17	17	26	26	33	33	53	53	66	66	66	66	124.7	149.6	149.6
Maximum Refrigerant Pressure (psig)	656	656	656	656	656	656	656	656	656	656	656	656	656	656	656
HYDRONIC MODULE (Optional)†	Pump(s), Strainer with Blowdown Valve, Expansion Tank, Pressure Taps, Drain and Vent Plugs, Flow Switch, and Balance Valve														
Pump	Single or Dual, Centrifugal Monocell Pump(s), 3500 Rpm. Dual pumps with check valves and isolation valves.														
Expansion Tank Volume (gal) Total/Acceptance	4.4/3.2						10.3/10.3						—	—	—
CHASSIS DIMENSIONS (ft - in.)															
Length	5-7	5-7	7-5	7-5	7-5	7-5	7-5	7-5	7-5	7-5	7-5	7-5	12-7	12-7	12-7
Width	3-5	3-5	3-5	3-5	3-5	3-5	7-9	7-9	7-9	7-9	7-9	7-9	7-4	7-4	7-4
Height	5-6	5-6	5-6	5-6	6-6	6-6	5-6	5-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6

LEGEND

EXV — Electronic Expansion Valve
MCHX — Microchannel Heat Exchanger

*All units have Victaulic connections, sized for IPS Carbon Steel piping.

†Flow switch and strainer are standard on all units, with or without hydronic package.

Carrier®

SI

UNIT 30RAP	010	015	018	020	025	030	035	040	045	050	055	060	070	080	090
OPERATING WEIGHT (kg)															
MCHX Condenser Coil, No Pump	319	326	510	514	564	582	981	991	1015	1026	1075	1077	1547	1652	1677
MCHX Condenser Coil, Single Pump	393	399	584	588	637	656	1137	1147	1171	1182	1231	1233	1729	1830	1842
MCHX Condenser Coil, Dual Pump	467	473	658	661	711	729	1293	1303	1327	1338	1386	1389	1856	1991	2001
REFRIGERANT TYPE	R-410A, EXV Controlled System														
Total Refrigerant Charge (kg)	3.9	4.4	6.6	7.1	7.6	8.0	13.4	13.6	15.6	15.7	16.0	16.1	27.5	31.8	32.2
Refrigerant Charge (kg) Ckt A/Ckt B	3.9/—	4.4/—	6.6/—	7.1/—	7.6/—	8.0/—	6.8/6.7	6.8/6.8	7.8/7.8	7.8/7.8	7.9/8.1	8.1/8.1	11.6/ 15.9	15.9/ 15.9	16.1/ 16.1
COMPRESSORS	Scroll, Hermetic														
Quantity	1	1	2	2	2	2	4	4	4	4	4	4	5	6	6
Speed (R/s)	58.3														
(Qty, kW) Ckt A	(1) 38	(1) 53	(2) 32	(2) 35	(2) 46	(2) 53	(2) 35	(2) 35	(2) 38	(2) 46	(2) 46	(2) 53	(2) 53	(3) 46	(3) 53
(Qty, kW) Ckt B	—	—	—	—	—	—	(2) 32	(2) 38	(2) 46	(2) 46	(2) 53	(2) 53	(3) 53	(3) 53	(3) 53
Oil Charge (L) Ckt A/Ckt B	3.3/—	3.3/—	6.5/—	6.5/—	6.5/—	6.5/—	6.5/6.5	6.5/6.5	6.5/6.5	6.5/6.5	6.5/6.5	6.5/6.5	6.5/9.7	9.7/9.7	9.7/9.7
No. Capacity Steps															
Standard	1	1	2	2	2	2	4	4	4	4	4	4	5	6	6
With Hot Gas Bypass	—	—	3	3	3	3	5	5	5	5	5	5	6	7	7
Digital Compressor Option	13	13	22	22	22	22	44	44	44	44	44	44	55	66	66
Minimum Capacity Step (%)															
Standard	100	100	50	50	50	50	23	23	24	25	23	25	20	15	17
With Hot Gas Bypass	—	—	20	24	29	32	9	11	12	14	13	16	13	9	11
Digital Compressor Option	20	20	17	15	15	15	8	8	8	8	8	8	6	5	5
Capacity (%)															
Circuit A	100	100	100	100	100	100	54	47	47	50	46	50	40	46	50
Circuit B	—	—	—	—	—	—	46	53	53	50	54	50	60	54	50
COOLER	Brazed, Direct-Expansion Plate Heat Exchanger														
Weight (kg) (empty)	10.1	12.5	14.4	18.3	21.0	36.6	45.1	53.5	56.8	62.4	72.8	72.8	89.4	103.4	111.1
Net Fluid Volume (L)	2.3	3.0	3.4	4.5	5.3	7.6	9.8	12.5	13.2	15.5	18.9	18.9	16.3	18.9	25.7
Maximum Refrigerant Pressure (kPa)	3482	3482	3482	3482	3482	3896	3896	3896	3896	3896	3896	3896	3103	3103	3103
Maximum Water-Side Pressure Without Pump(s) (kPa)	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068	2068
Maximum Water-Side Pressure With Pump(s) (kPa)	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034	1034
CHILLER WATER CONNECTIONS (in.)															
Inlet and Outlet, Victaulic (IPS Carbon Steel)*	2	2	2	2	2	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	3	3	3
Drain (NPT)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
CONDENSER FANS															
Standard Low-Sound AeroAcoustic™ Type	Plastic Type, Axial, Vertical Discharge														
Fan Speed (R/s)	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
No. Blades...Diameter (mm)	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762	9...762
No. Fans	1	1	2	2	2	2	3	3	3	3	4	4	5	6	6
Total Airflow (L/s)	4400	4400	8300	8300	9200	9200	14,000	14,000	14,400	14,400	18,300	18,300	22,889	27,467	27,467
Optional Value Sound Type	Propeller Type, Axial, Vertical Discharge														
Fan Speed (R/s)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
No. Blades...Diameter (mm)	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762	4...762
No. Fans	1	1	2	2	2	2	3	3	3	3	4	4	5	6	6
Total Airflow (L/s)	4800	4800	8700	8700	9900	9900	15,100	15,100	15,700	15,700	19,700	19,700	24,187	29,025	29,025
CONDENSER COILS	Novation® MCHX Aluminum Tube, Aluminum Fin														
Quantity (Ckt A/Ckt B)	1/—	1/—	1/—	1/—	1/—	1/—	1/1	1/1	1/1	1/1	1/1	1/1	2/3	3/3	3/3
Total Face Area (sq m)	1.6	1.6	2.4	2.4	3.1	3.1	4.9	4.9	6.1	6.1	6.1	6.1	11.6	13.9	13.9
Maximum Refrigerant Pressure (kPa)	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523	4523
HYDRONIC MODULE (Optional)†	Pump(s), Strainer with Blowdown Valve, Expansion Tank, Pressure Taps, Drain and Vent Plugs, Flow Switch, and Balance Valve														
Pump	Single or Dual, Centrifugal Monocell Pump(s), 3500 Rpm. Dual pumps with check valves and isolation valves.														
Expansion Tank Volume (L) Total/Acceptance	17.4/12.3						39.0/39.0						—	—	—
CHASSIS DIMENSIONS (mm)															
Length	1689	1689	2242	2242	2242	2242	2248	2248	2248	2248	2248	2248	3826	3826	3826
Width	1029	1029	1025	1025	1025	1025	2350	2350	2350	2350	2350	2350	2241	2241	2241
Height	1689	1689	1689	1689	1994	1994	1689	1689	1994	1994	1994	1994	1976	1976	1976

LEGEND

EXV — Electronic Expansion Valve
MCHX — Microchannel Heat Exchanger

*All units have Victaulic connections, sized for IPS Carbon Steel piping.

†Flow switch and strainer are standard on all units, with or without hydronic package.

Physical data (cont)

UNIT WEIGHTS
STANDARD UNITS

30RAP SIZE	POUNDS				
	A	B	C	D	Total Weight
010	188	209	161	146	704
015	193	213	163	149	718
018	363	264	209	288	1125
020	365	266	211	290	1133
025	393	290	237	321	1242
030	405	301	246	331	1283
035	652	730	413	369	2163
040	704	697	390	394	2185
045	675	758	425	379	2238
050	732	724	401	405	2263
055	744	762	437	427	2369
060	746	762	438	429	2375
070	930	984	727	770	3410
080	936	1038	791	877	3641
090	952	1057	800	888	3697

30RAP SIZE	KILOGRAMS				
	A	B	C	D	Total Weight
010	86	95	73	66	319
015	88	97	74	67	326
018	165	120	95	131	510
020	166	121	96	132	514
025	178	132	108	146	564
030	184	136	112	150	582
035	296	331	187	167	981
040	319	316	177	179	991
045	306	344	193	172	1015
050	332	328	182	184	1026
055	337	346	198	194	1075
060	338	346	199	195	1077
070	422	446	330	349	1547
080	425	471	359	398	1652
090	432	479	363	403	1677

SINGLE PUMP UNITS

30RAP SIZE	POUNDS				
	A	B	C	D	Total Weight
010	215	264	213	174	866
015	220	268	215	177	880
018	404	306	249	329	1288
020	406	308	251	331	1296
025	434	332	277	362	1405
030	446	342	286	372	1446
035	677	877	537	415	2507
040	728	846	513	441	2529
045	701	906	550	425	2582
050	756	873	524	453	2606
055	768	910	561	474	2713
060	771	910	562	476	2719
070	1036	1032	871	874	3812
080	1054	1070	963	948	4035
090	1063	1082	967	950	4061

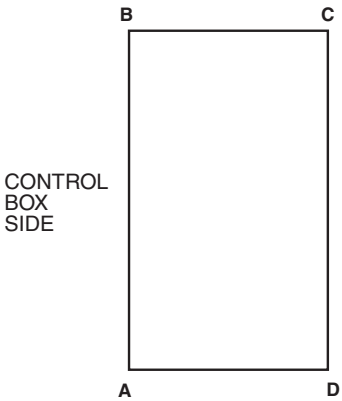
30RAP SIZE	KILOGRAMS				
	A	B	C	D	Total Weight
010	98	120	97	79	393
015	100	122	98	80	399
018	183	139	113	149	584
020	184	140	114	150	588
025	197	151	126	164	637
030	202	155	130	169	656
035	307	398	244	188	1137
040	330	384	233	200	1147
045	318	411	249	193	1171
050	343	396	238	206	1182
055	349	413	254	215	1231
060	350	413	255	216	1233
070	470	468	395	396	1729
080	478	485	437	430	1830
090	482	491	438	431	1842

DUAL PUMP UNITS

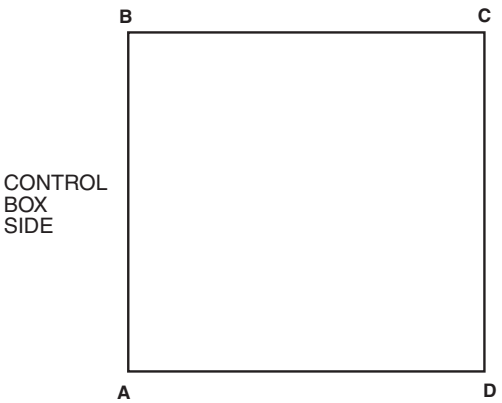
30RAP SIZE	POUNDS				
	A	B	C	D	Total Weight
010	242	319	266	202	1029
015	247	323	268	205	1043
018	445	347	288	370	1450
020	447	349	290	372	1458
025	475	373	316	403	1567
030	487	383	325	413	1608
035	705	1022	664	459	2850
040	755	992	639	486	2872
045	729	1051	677	469	2925
050	783	1019	649	499	2950
055	796	1055	687	518	3056
060	798	1056	688	520	3062
070	1123	1036	928	1005	4092
080	1159	1094	1038	1099	4390
090	1167	1104	1041	1099	4411

30RAP SIZE	KILOGRAMS				
	A	B	C	D	Total Weight
010	110	145	121	92	467
015	112	147	121	93	473
018	202	157	131	168	658
020	203	158	132	169	661
025	216	169	144	183	711
030	221	174	147	187	729
035	320	463	301	208	1293
040	343	450	290	221	1303
045	331	477	307	213	1327
050	355	462	295	226	1338
055	361	479	312	235	1386
060	362	479	312	236	1389
070	509	470	421	456	1856
080	526	496	471	499	1991
090	529	501	472	499	2001

30RAP010-030 UNITS



30RAP035-090 UNITS



NOTE: When the accessory storage tank is employed, the value for total weight increases (to be added to the weights shown above) by 1673 pounds (759 kg) on 30RAP010-015, by 2193 pounds (995 kg) on 30RAP018-030, and by 4361 pounds (1978 kg) on 30RAP035-060. Even with the storage tank, all 30RAP chillers require only 4-point support.

Options and accessories

ITEM	FACTORY-INSTALLED OPTION	FIELD-INSTALLED ACCESSORY
Condenser Coil and Sound Options		
MCHX E-Coat	X	
Low Sound Compressor Blankets		X
Value Sound Fans	X	
Ultra-Low Sound	X	
Controls/Communication Options		
BACnet Communications	X	
BACnet Translator Control		X
Chillervisor System Manager III Multi-Unit Control		X
Energy Management Module (EMM)	X	X
LON (Local Operating Network) Translator Control		X
Navigator™ Display		X
Remote Enhanced Display		X
Touch Pilot™ Display		X
Cooler Options		
Freeze Protection — Cooler Heaters	X	
Remote Cooler Kit		X
Electrical Options		
Unit-Mounted Main Disconnect, Non-Fused (not available with dual point power)	X	
GFI Convenience Outlet (115 v)	X	X
High SCCR (Short Circuit Current Rating)	X	
Hydronics Option		
Hydronic Pump Package	X	
Fluid Storage Tank (available on sizes 010-060)		X
Variable Frequency Drive (VFD) (available on sizes 070-090)	X	
Refrigeration Circuit Options		
Compression Suction Service Valves (available on sizes 070-090)	X	
Low Ambient Temperature Head Pressure Control	X	X
Hot Gas Bypass (not available on sizes 010 and 015)	X	X
Digital Compressor	X	
Security/Packaging Options		
Security Grilles/Hail Guards	X	X
Vibration Isolation		X
Wind Baffles		X

Factory-installed options

Novation® heat exchanger technology microchannel coil (aluminum fin/aluminum tube) e-coat condenser is available for optimum durability. Novation heat exchangers with microchannel coil technology are offered coated or uncoated to match coil protection to site conditions. The Carrier Electronic Catalog (E-Cat) can be used to determine whether or not corrosion protection is recommended for particular applications in coastal/marine environments. Following the input of the requested data, the E-Cat program output will advise the appropriate coil to be used. Other factors described in "Selection Guide: Environmental Corrosion Protection, Novation Heat Exchanger with Microchannel Coil Technology" catalog number 04-581042-01 must also be considered to determine if corrosion protection is required.

Value sound fans provide a metal, propeller-type fan system which is cost-effective when compared to the low-sound AeroAcoustic™ fan system. This factory-installed fan option is compatible with the Motormaster® V option.

Ultra-low sound provides a combination of low sound AeroAcoustic™ fans with sound blankets.

Digital compressor control allows incremental unloading for a closer match to building load. This option is not available on any application with a leaving fluid temperature below 35 F (2 C).

High short circuit current rating provides a short circuit current rating protection for the unit up to 65,000 A on 460-v, 380-v, and 208/230-v units or 25,000 A on 575-v units.

Motormaster® V low-ambient control provides control of fan motor operation to maintain head pressure at low outdoor ambient temperatures down to –20 F (–29 C) This option also requires field-installed wind baffles. This option is also available as an accessory. This option is a standard feature on all 30RAP010 and 015 chillers.

Non-fused disconnect includes factory-installed non-fused disconnect capability for power and control located at the unit. This is not available on dual point power.

Energy management module (EMM) provides energy management capabilities to minimize chiller energy consumption. Several features are provided with this module including leaving fluid temperature reset, cooling set point reset or demand limit control from a 4 to 20 mA signal, 2-point demand limit control (from 0 to 100%) activated by a remote contact closure, and discrete input for “Ice Done” indication for ice storage system interface. The EMM is also available as an accessory.

Freeze protection with cooler heaters provides protection from cooler freeze-up to –20 F (–29 C).

GFI convenience outlet is a factory-installed convenience outlet that includes 4-amp GFI (ground fault

Options and accessories (cont)

interrupter) receptacle with independent fuse protection. Convenience outlet is 115-v female receptacle. This option is also available as an accessory.

Compressor suction service valve provides additional isolation of the compressor from the cooler vessel for service. This option is only available on sizes 070-090.

Hydronic pump package option adds circulating pumps, complete with controls, contactor, VFD compatible motors, and insulated expansion tank (expansion tank available on sizes 010-060 only). Available in single or dual (lead/lag controlled) cooler pump versions, with total dynamic head external to the chiller from approximately 15 to 160 ft (4.6 to 48.8 m). A VFD option is available on sizes 070-090.

Hot gas bypass option allows additional capacity reduction for unit operation down below the minimum standard step of capacity. This option is not available on units with the digital compressor option, on the 30RAP010 and 015 units, or any application with a leaving fluid temperature below 35 F (2 C). This option is also available as an accessory on all 30RAP units without digital compressors.

Security grilles/hail guards consist of louvered, sheet metal panels which securely fasten to the chiller and provide condenser coil protection against hail and physical damage. This option is also available as an accessory.

BACnet communication option — Provides factory installed communication capability with a BACnet MS/TP network. Allows integration with i-Vu® Open control system or a BACnet building automation system.

Field-installed accessories

BACnet translator control provides an interface between the unit and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485). Field programming is required.

Chillervisor System Manager III multi-unit control accessory allows sequencing of between two and eight chillers in parallel. Pump control is also provided.

Energy management module provides energy management capabilities to minimize chiller energy consumption. Several features are provided with this module including leaving fluid temperature reset, cooling set point reset or demand limit control from a 4 to 20 mA signal, 2-point demand limit control (from 0 to 100%) activated by a remote contact closure, and discrete input for "Ice Done" indication for ice storage system interface. The EMM is also available as an option.

LON (local operating network) translator control provides an interface between the unit and a local operating network (i.e., LonWorks* FT-10A ANSI/EIA-709.1). Field programming is required.

Navigator™ display module provides a portable, hand held display module for convenient access to unit status, operation, configuration and troubleshooting diagnostics capability. The 4-line, 80-character LCD (liquid crystal display) display provides clear language information in English, French, Spanish or Portuguese. The weatherproof enclosure and industrial grade extension cord make the Navigator module ideally suited for outdoor applications. Magnets located on the back of the module allow attachment of any sheet metal component for hands free operation.

Remote enhanced display accessory kit contains a remotely mounted 40-character per line, 16-line display panel for unit diagnostics.

Touch Pilot™ display is a cost-effective, touch-screen, remote-mount device that can be used in lieu of the remote enhanced display.

Motormaster® V low-ambient control provides control of outdoor-fan motor operation to maintain head pressure at low outdoor ambient temperatures down to –20 F (–29 C). This accessory also requires field-installed wind baffles. This accessory is also available as a factory-installed option. This accessory is standard on 30RAP010 and 015 units.

Chilled water storage tank provides a minimum of 4 gallons per ton loop storage capacity. Includes insulated steel shell tank, Victaulic pipe connections, electric tank heaters, electric cables, vent, drain, and enclosure to allow tank to be installed under the chiller to protect to –20 F (–29 C). The power supply for the storage tank is obtained from the chiller, so no separate power source is required for this accessory. This is available with sizes 010-060 only.

Vibration isolation consists of field-installed 1/4-in. (0.64 cm) neoprene isolator pads (24-in. x 3-in.) (61.0 cm x 7.6 cm) that reduce vibration transmission from the compressor through the floor and into the conditioned space.

Low sound compressor blankets reduce unit sound levels by providing an acoustic blanket on each compressor.

Hot gas bypass accessory allows additional capacity reduction for unit operation below the minimum standard step of capacity. This accessory is not available on units which have the digital compressor option or any application with a leaving fluid temperature below 35 F (2 C). This field-installed accessory is also available as a factory-installed option, but the factory option is not available with digital compressors or unit sizes 010 or 015.

Remote cooler kit provides the additional hardware required to remotely mount the cooler from the unit. There are limits to total separation of the unit to the cooler as well as vertical separation limits, and these are delineated in the accessory installation instructions. Never bury refrigerant piping on these or any other applications.

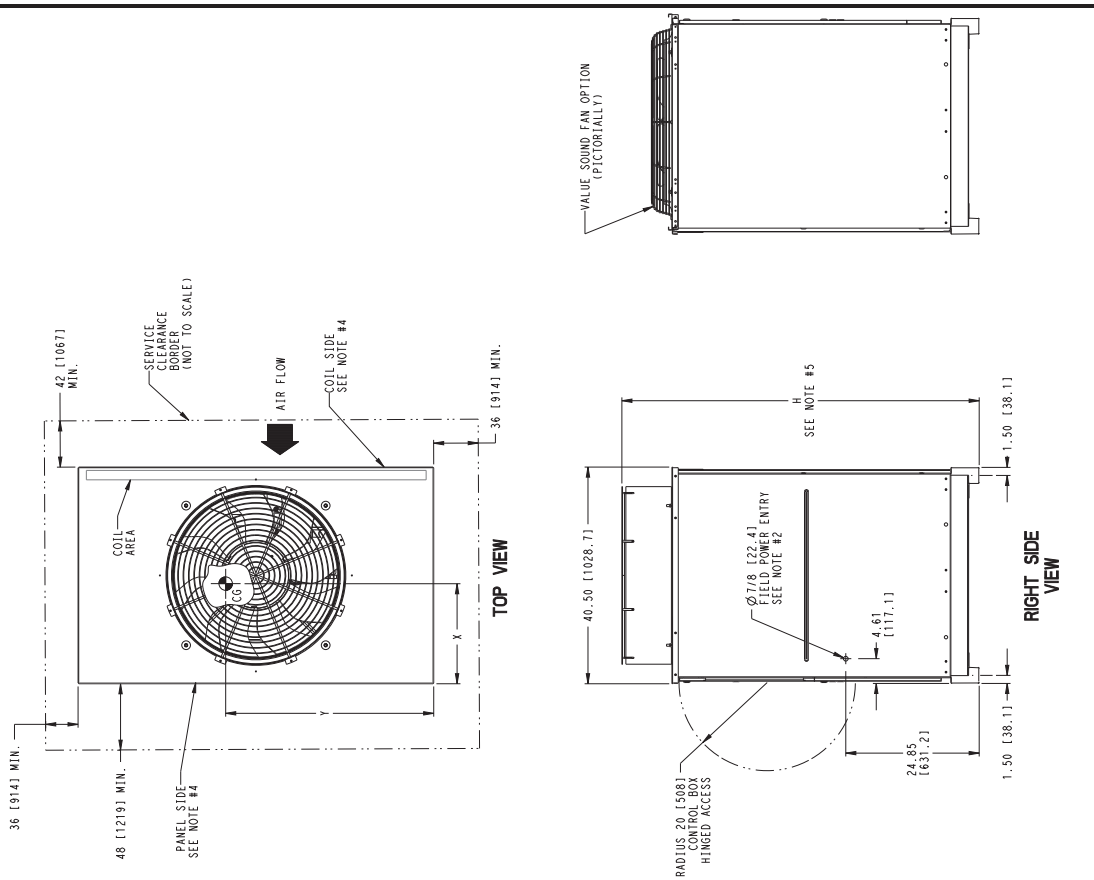
GFI convenience outlet is a field-installed convenience outlet that includes a 4-amp GFI (ground fault interrupter) receptacle with independent fuse protection. The convenience outlet is a 115-v female receptacle. The GFI convenience outlet is also available as a factory-installed option.

Security grilles/hail guards consist of louvered, sheet metal panels which securely fasten to the chiller and provide condenser coil protection against hail and physical damage. Security grilles/hail guards are also available as a factory-installed option.

Wind baffles facilitate operation down to –20 F (–29 C) when used in conjunction with low ambient temperature head pressure control.

*Registered trademark of Echelon Corporation.

Base unit dimensions — 30RAP010,015

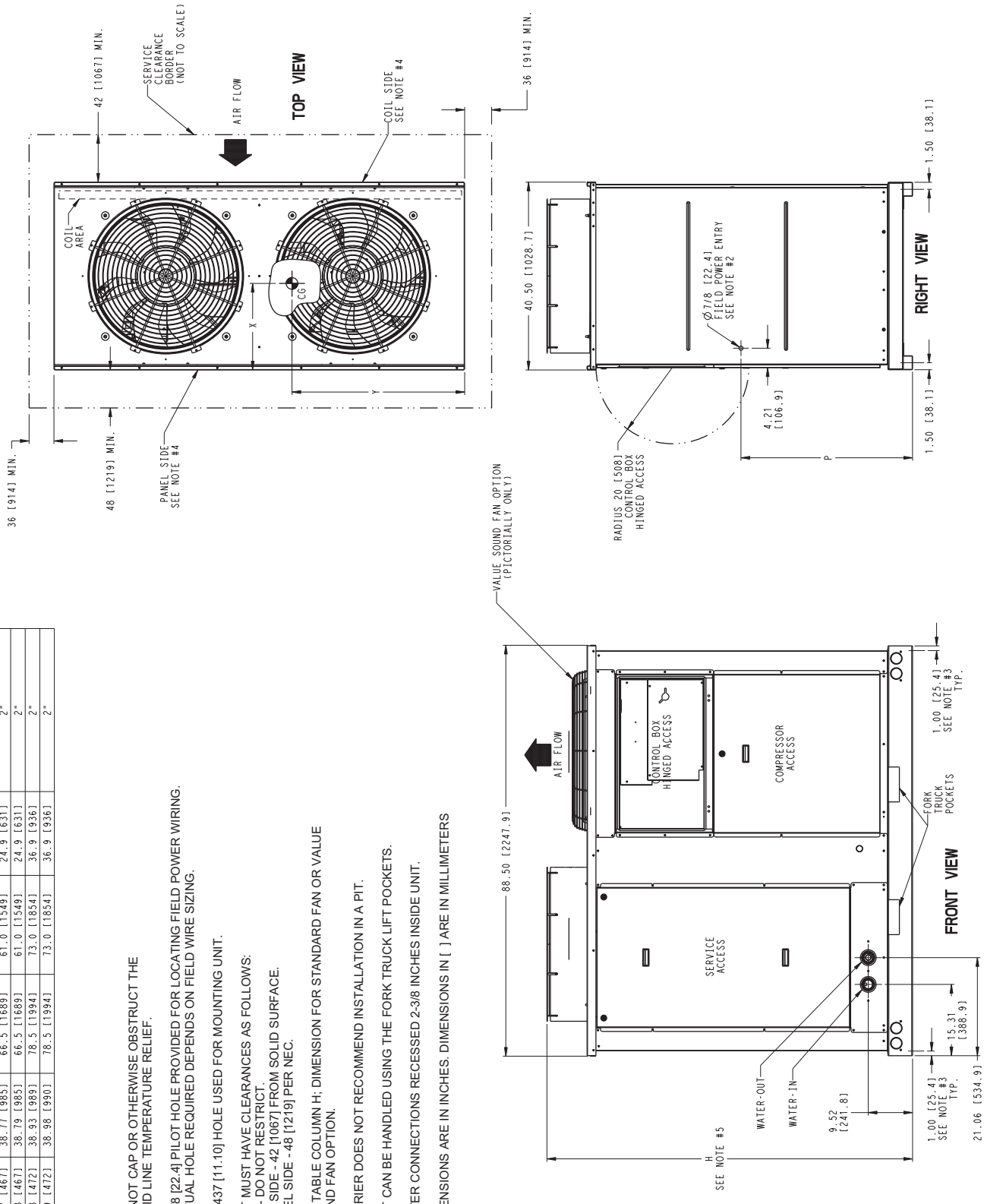


	UNIT	CENTER OF GRAVITY		UNIT HEIGHT		VICTAULIC CONNECTIONS
		X	Y	H (STANDARD)	H (VALUE SOUND)	WATER IN/OUT
STANDARD	30RAP010	18.40 [467]	37.80 [960]	66.5 [1689]	61.0 [1549]	2"
	30RAP015	18.35 [466]	37.69 [957]	66.5 [1689]	61.0 [1549]	2"

NOTES:

1. DO NOT CAP OR OTHERWISE OBSTRUCT THE LIQUID LINE TEMPERATURE RELIEF.
2. Ø7/8 [22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
3. Ø0.437 [11.10] HOLE USED FOR MOUNTING UNIT.
4. UNIT MUST HAVE CLEARANCES AS FOLLOWS:
   TOP - DO NOT RESTRICT
   COIL SIDE - 42 [1067] FROM SOLID SURFACE.
   PANEL SIDE - 48 [1219] PER NEC.
5. SEE TABLE COLUMN H; DIMENSION FOR STANDARD FAN OR VALUE SOUND FAN OPTION.
6. CARRIER DOES NOT RECOMMEND INSTALLATION IN A PIT.
7. UNIT CAN BE HANDLED USING THE FORK TRUCK LIFT POCKETS.
8. WATER CONNECTIONS RECESSED 2-3/8 INCHES INSIDE UNIT.
9. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS

Base unit dimensions — 30RAP018-030

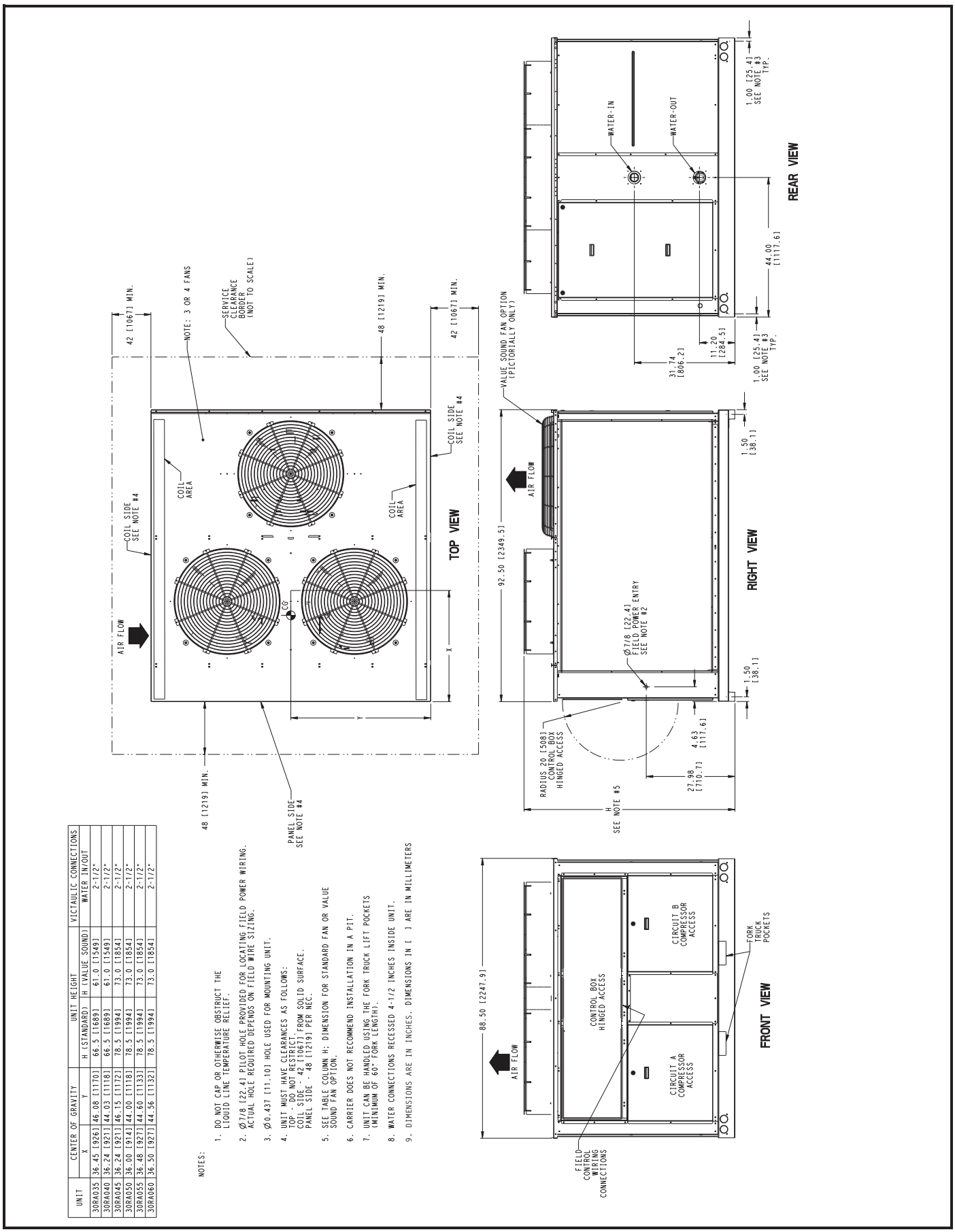


UNIT	CENTER OF GRAVITY		UNIT HEIGHT		POWER ENTRY	VICTAULIC CONNECTIONS
	X	Y	H (STANDARD)	H (VALUE SOUND)	P	WATER IN/OUT
30RA018	18.37 [467]	38.77 [985]	66.5 [1689]	61.0 [1549]	24.9 [631]	2"
30RA020	18.38 [467]	38.79 [985]	66.5 [1689]	61.0 [1549]	24.9 [631]	2"
30RA025	18.58 [472]	38.93 [989]	78.5 [1994]	73.0 [1854]	36.9 [936]	2"
30RA030	18.59 [472]	38.98 [990]	78.5 [1994]	73.0 [1854]	36.9 [936]	2"

NOTES:

1. DO NOT CAP OR OTHERWISE OBSTRUCT THE LIQUID LINE TEMPERATURE RELIEF.
2. Ø 7/8 [22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
3. Ø 0.437 [11.10] HOLE USED FOR MOUNTING UNIT.
4. UNIT MUST HAVE CLEARANCES AS FOLLOWS:
   TOP - DO NOT RESTRICT.
   COIL SIDE - 42 [1067] FROM SOLID SURFACE.
   PANEL SIDE - 48 [1219] PER NEC.
5. SEE TABLE COLUMN H; DIMENSION FOR STANDARD FAN OR VALUE SOUND FAN OPTION.
6. CARRIER DOES NOT RECOMMEND INSTALLATION IN A PIT.
7. UNIT CAN BE HANDLED USING THE FORK TRUCK LIFT POCKETS.
8. WATER CONNECTIONS RECESSED 2-3/8 INCHES INSIDE UNIT.
9. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS

Base unit dimensions — 30RAP035-060

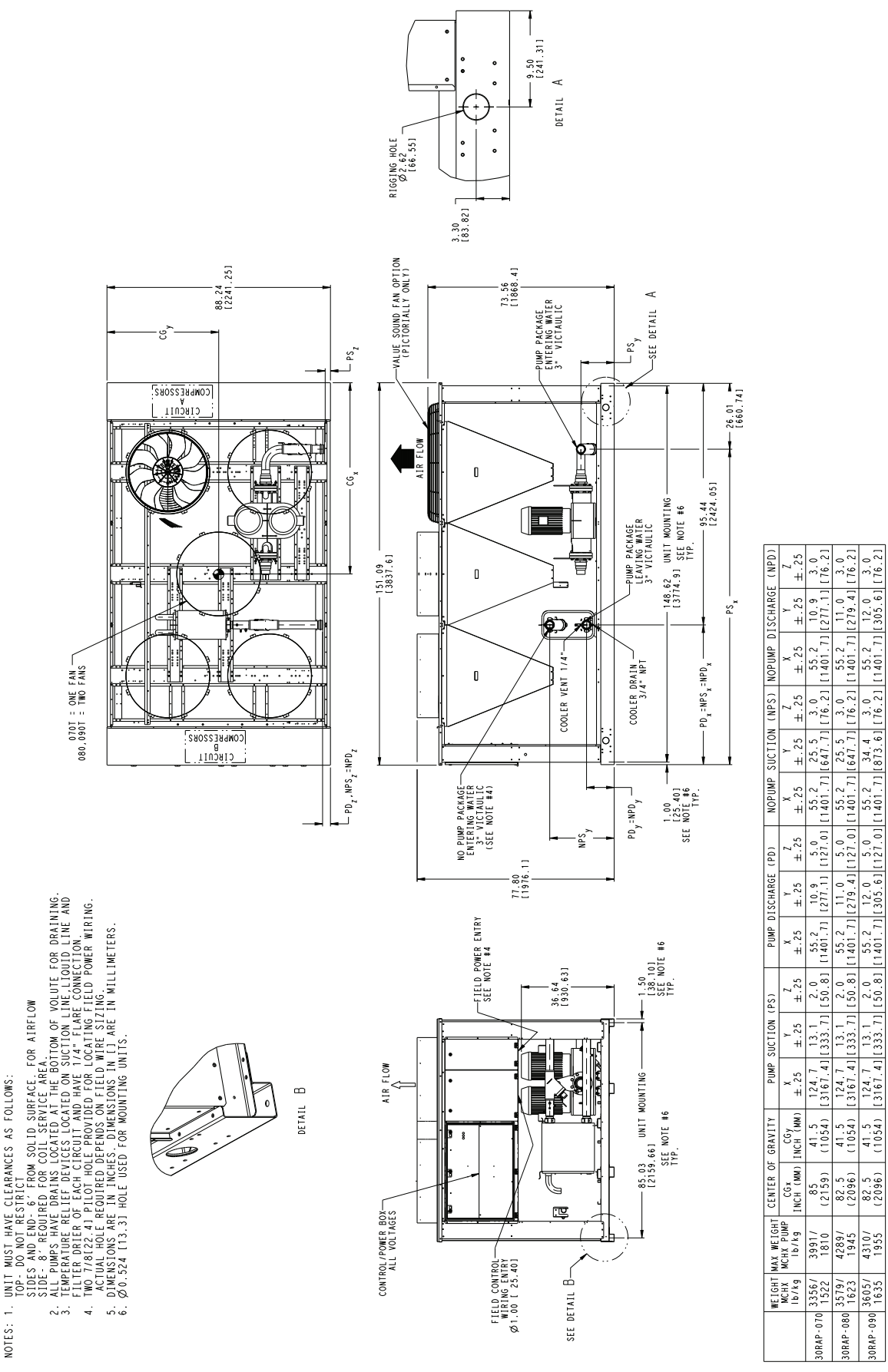


UNIT	CENTER OF GRAVITY		UNIT HEIGHT		VICTAULIC CONNECTIONS
	X	Y	H (STANDARD)	H (VALUE SOUND)	WATER IN/OUT
30RAO35	36.45 [926]	46.08 [1170]	66.5 [1689]	61.0 [1549]	2-1/2"
30RAO40	36.24 [921]	44.03 [1118]	66.5 [1689]	61.0 [1549]	2-1/2"
30RAO45	36.24 [921]	46.15 [1172]	78.5 [1994]	73.0 [1854]	2-1/2"
30RAO50	36.00 [914]	44.00 [1118]	78.5 [1994]	73.0 [1854]	2-1/2"
30RAO55	36.48 [927]	44.60 [1133]	78.5 [1994]	73.0 [1854]	2-1/2"
30RAO60	36.50 [927]	44.56 [1132]	78.5 [1994]	73.0 [1854]	2-1/2"

NOTES:

1. DO NOT CAP OR OTHERWISE OBSTRUCT THE LIQUID LINE TEMPERATURE RELIEF.
2. Ø7/8 [22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
3. Ø0.437 [11.10] HOLE USED FOR MOUNTING UNIT.
4. UNIT MUST HAVE CLEARANCES AS FOLLOWS:
   TOP - DO NOT RESTRICT.
   COIL SIDE - 42 [1067] FROM SOLID SURFACE.
   PANEL SIDE - 48 [1219] PER NEC.
5. SEE TABLE COLUMN H; DIMENSION FOR STANDARD FAN OR VALUE SOUND FAN OPTION.
6. CARRIER DOES NOT RECOMMEND INSTALLATION IN A PIT.
7. UNIT CAN BE HANDLED USING THE FORK TRUCK LIFT POCKETS (MINIMUM OF 60" FORK LENGTH).
8. WATER CONNECTIONS RECESSED 4-1/2 INCHES INSIDE UNIT.
9. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS

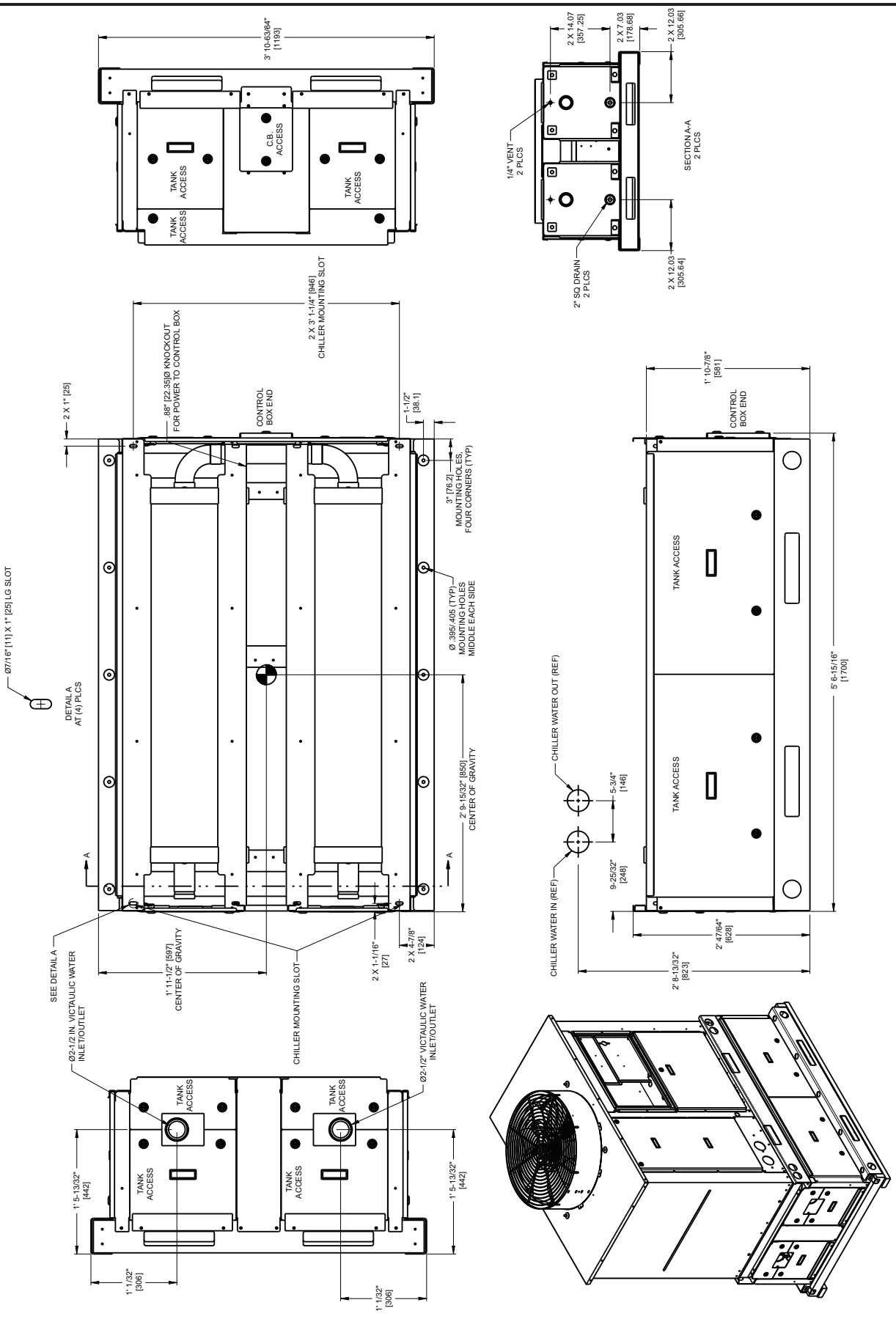
Base unit dimensions — 30RAP070-090


NOTES: 1. UNIT MUST HAVE CLEARANCES AS FOLLOWS:
TOP- DO NOT RESTRICT
SIDES AND END- 6' FROM SOLID SURFACE. FOR AIRFLOW
SIDE- 8' REQUIRED FOR COIL SERVICE AREA.
2. ALL PUMPS HAVE DRAINS LOCATED AT THE BOTTOM OF VOLUTE FOR DRAINING.
3. TEMPERATURE RELIEF DEVICES LOCATED ON SUCTION LINE,LIQUID LINE AND FILTER DRIER OF EACH CIRCUIT AND HAVE 1/4" FLARE CONNECTION.
4. TWO 7/8[22.4] PILOT HOLE PROVIDED FOR LOCATING FIELD POWER WIRING. ACTUAL HOLE REQUIRED DEPENDS ON FIELD WIRE SIZING.
5. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
6. Ø0.524 [13.3] HOLE USED FOR MOUNTING UNITS.
DETAIL B
070 = ONE FAN
080,090T = TWO FANS
CIRCUIT A COMPRESSORS
CIRCUIT B COMPRESSORS
88.24 [2241.25]
CGy
CGx
PSz
PDz-NPSz-NPDz
VALUE SOUND FAN OPTION (PICTORIALLY ONLY)
AIR FLOW
73.56 [1868.4]
PUMP PACKAGE ENTERING WATER 3" VICTAULIC
PSy
SEE DETAIL A
151.09 [3837.6]
NO PUMP PACKAGE ENTERING WATER 3 (SEE NOTE #4)
COOLER VENT 1/4"
COOLER DRAIN 3/4" NPT
PUMP PACKAGE LEAVING WATER 3" VICTAULIC
148.62 [3774.9]
UNIT MOUNTING SEE NOTE #6 TYP.
95.44 [2424.05]
PSx
26.01 [660.74]
PDx-NPSx-NPDx
NPSy
PDy-NPDy
77.80 [1976.1]
1.00 [25.40] SEE NOTE #6 TYP.
RIGGING HOLE Ø2.62 [66.55]
3.30 [83.82]
9.50 [241.31]
DETAIL A
FIELD POWER ENTRY SEE NOTE #4
36.64 [930.63]
1.50 [38.10] SEE NOTE #6 TYP.
CONTROL/POWER BOX ALL VOLTAGES
AIR FLOW
85.03 [2159.66] SEE NOTE #6 TYP.
UNIT MOUNTING
FIELD CONTROL WIRING ENTRY Ø1.00 [25.40]
SEE DETAIL B

	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY CGx INCH (MM)	CGy INCH (MM)	PUMP SUCTION (PS) X ±.25	Y ±.25	Z ±.25	PUMP DISCHARGE (PD) X ±.25	Y ±.25	Z ±.25	NOPUMP SUCTION (NPS) X ±.25	Y ±.25	Z ±.25	NOPUMP DISCHARGE (NPD) X ±.25	Y ±.25	Z ±.25
30RAP-070	3356/ 1522	3991/ 1810	85 (2159)	41.5 (1054)	124.7 [3167.4]	13.1 [333.7]	2.0 [50.8]	55.2 [1401.7]	10.9 [277.1]	5.0 [127.0]	55.2 [1401.7]	25.5 [647.7]	3.0 [76.2]	55.2 [1401.7]	10.9 [277.1]	3.0 [76.2]
30RAP-080	3579/ 1623	4289/ 1945	82.5 (2096)	41.5 (1054)	124.7 [3167.4]	13.1 [333.7]	2.0 [50.8]	55.2 [1401.7]	11.0 [279.4]	5.0 [127.0]	55.2 [1401.7]	25.5 [647.7]	3.0 [76.2]	55.2 [1401.7]	11.0 [279.4]	3.0 [76.2]
30RAP-090	3605/ 1635	4310/ 1955	82.5 (2096)	41.5 (1054)	124.7 [3167.4]	13.1 [333.7]	2.0 [50.8]	55.2 [1401.7]	12.0 [305.6]	5.0 [127.0]	55.2 [1401.7]	34.4 [873.6]	3.0 [76.2]	55.2 [1401.7]	12.0 [305.6]	3.0 [76.2]

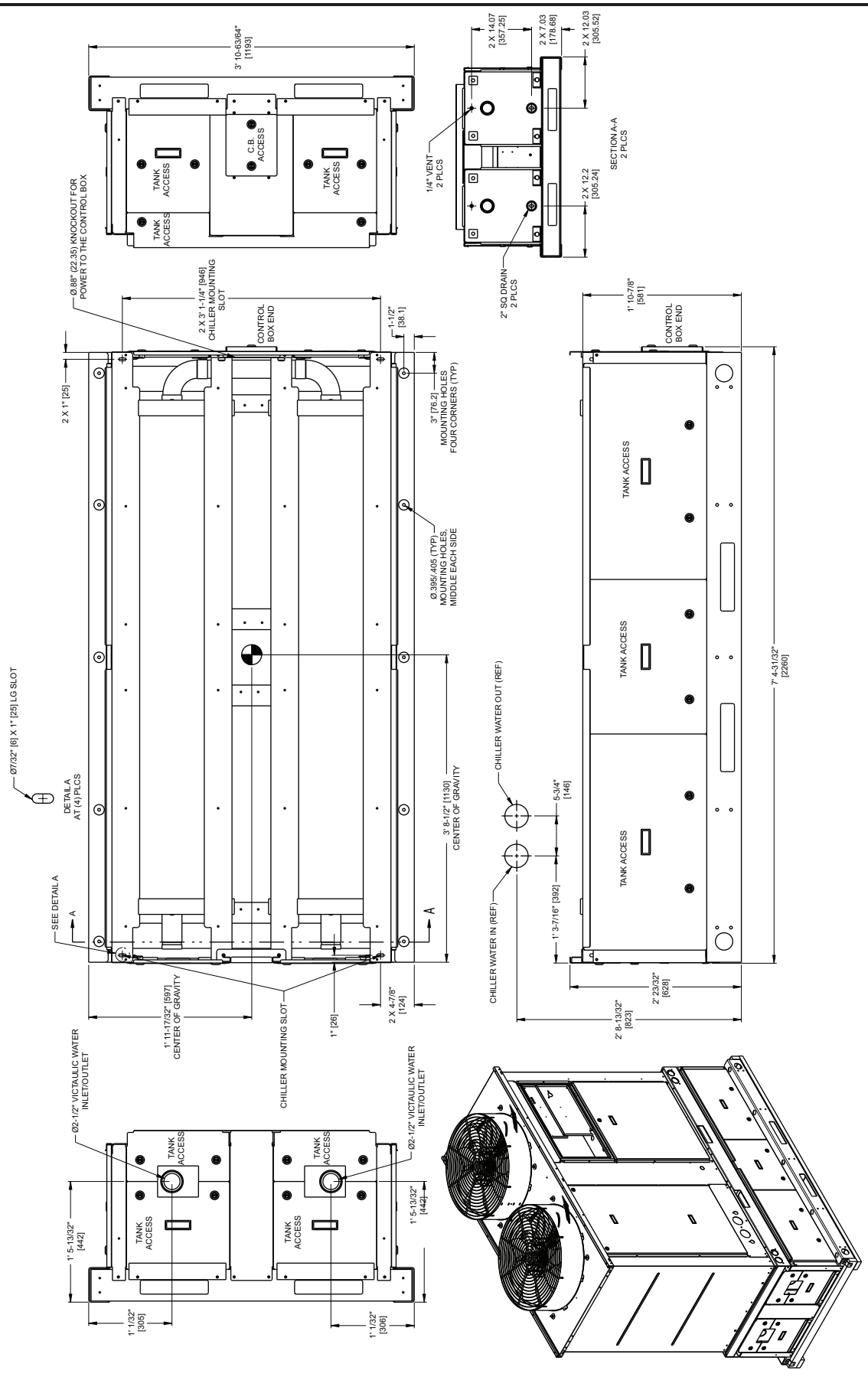
Accessory dimensions

ACCESSORY STORAGE TANK FOR UNIT SIZES 010-015

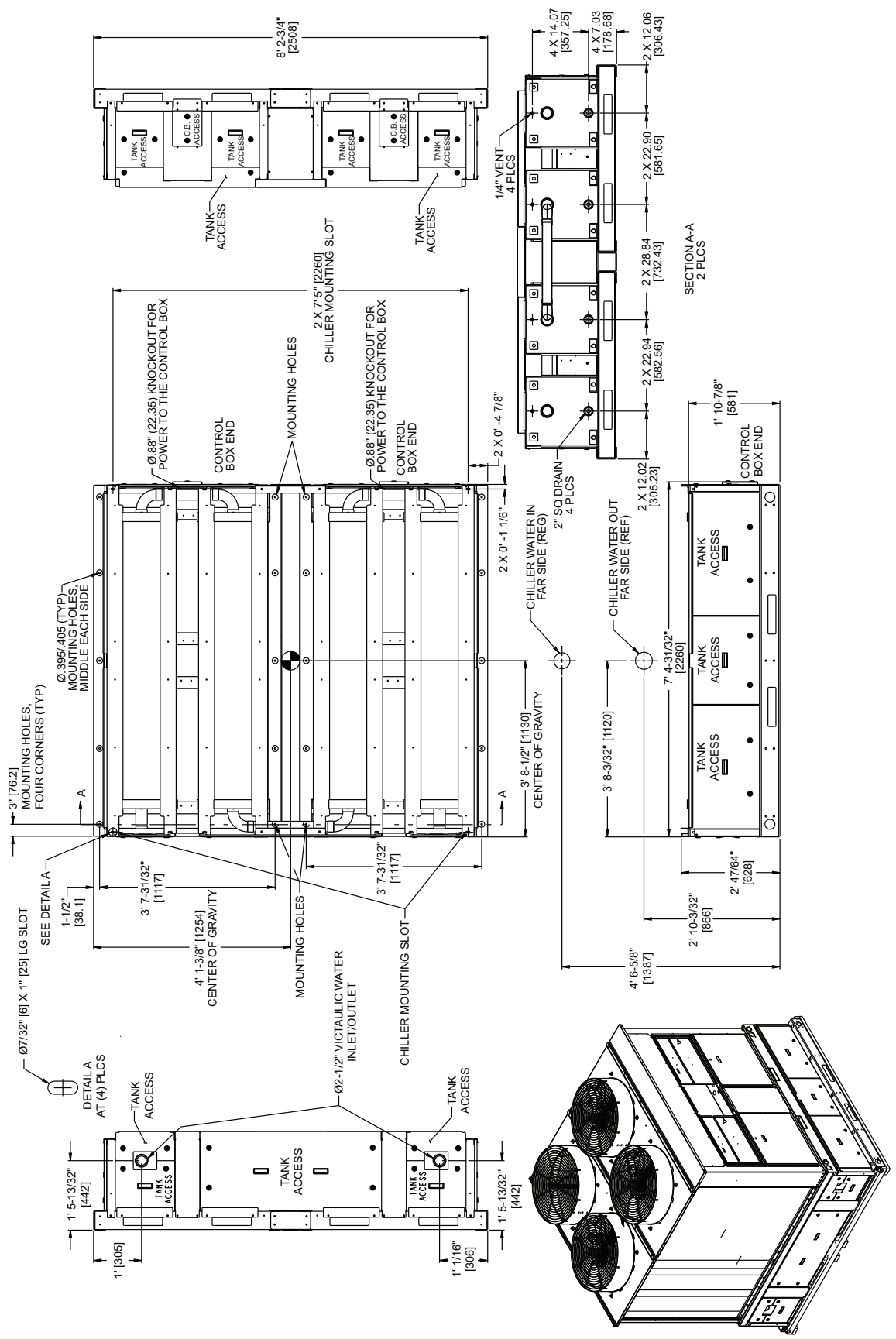


Accessory dimensions (cont)

ACCESSORY STORAGE TANK FOR UNIT SIZES 018-030


3' 10-63/64" [1193]
TANK ACCESS
C.B. ACCESS
Ø.88" (22.35) KNOCKOUT FOR POWER TO THE CONTROL BOX
2 X 14.07 [357.25]
2 X 7.03 [178.68]
2 X 12.03 [305.52]
1/4" VENT 2 PLCS
2 X 12.2 [305.24]
SECTION A-A 2 PLCS
2" SQ DRAIN 2 PLCS
2 X 3' 1-1/4" [946] CHILLER MOUNTING SLOT
CONTROL BOX END
1-1/2" [38.1]
2 X 1" [25]
3" [76.2] MOUNTING HOLES FOUR CORNERS (TYP)
Ø.395/.405 (TYP) MOUNTING HOLES, MIDDLE EACH SIDE
Ø7/32" [6] X 1" [25] LG SLOT
DETAIL A AT (4) PLCS
SEE DETAIL A
3' 8-1/2" [1130] CENTER OF GRAVITY
1' 11-17/32" [597] CENTER OF GRAVITY
1" [26]
2 X 4-7/8" [124]
CHILLER MOUNTING SLOT
Ø2-1/2" VICTAULIC WATER INLET/OUTLET
1' 5-13/32" [442]
1' 1/32" [305]
1' 1/32" [306]
1' 10-7/8" [581]
7' 4-31/32" [2260]
CHILLER WATER OUT (REF)
CHILLER WATER IN (REF)
5-3/4" [146]
1' 3-7/16" [392]
2' 23/32" [628]
2' 8-13/32" [823]

ACCESSORY STORAGE TANK FOR UNIT SIZES 035-060



CH-1

Selection procedure

Carrier's electronic catalog chiller selection program provides quick, easy selection of Carrier chillers. The program considers specific temperature, fluid, flow requirements, system pressure drop (for proper pump selection, when required), as well as other factors, such as fouling and altitude correction.

To select a 30RAP chiller, including optional pump package when required, use the NACO (North American Commercial Operation) Packaged Chiller Builder Program.

PUMP IMPELLER SIZES

UNIT 30RAP	PUMP Hp	SINGLE PUMP					DUAL PUMP				
		Option Code*		Rpm	Impeller Dia. (in.)	Pump Curve	Option Code*		Rpm	Impeller Dia. (in.)	Pump Curve
		non-VFD	VFD				non-VFD	VFD			
010-030	1.5	2	N/A	3500	4.25	I	9	N/A	3500	4.25	I
	3	3	N/A	3500	4.75	I	B	N/A	3500	4.75	I
	3 (high head)	4	N/A	3500	5.00	I	C	N/A	3500	5.00	I
	5	5	N/A	3500	5.50	II	D	N/A	3500	5.50	II
035-045	3	3	N/A	3500	4.75	I	B	N/A	3500	4.75	I
	3 (high head)	4	N/A	3500	5.25	I	C	N/A	3500	5.25	I
	5	5	N/A	3500	4.50	III	D	N/A	3500	4.50	III
	5 (high head)	6	N/A	3500	4.88	III	F	N/A	3500	4.88	III
	7.5	7	N/A	3500	5.50	IV	G	N/A	3500	5.50	IV
050-060	3 (high head)	4	N/A	3500	5.25	I	C	N/A	3500	5.25	I
	5	5	N/A	3500	4.50	III	D	N/A	3500	4.50	III
	5 (high head)	6	N/A	3500	4.88	III	F	N/A	3500	4.88	III
	7.5	7	N/A	3500	5.50	IV	G	N/A	3500	5.50	IV
	10	Z	N/A	3500	6.00	IV	H	N/A	3500	6.00	IV
070	3	1	C	3500	4.00	V	6	J	1750	6.50	VII
	5	2	D	3500	4.75	V	7	K	3500	4.50	VIII
	7.5	3	F	3500	5.25	VI	8	L	3500	5.25	IX
	10	4	G	3500	5.75	VI	9	M	3500	5.90	IX
080-090	5	2	D	3500	4.75	V	7	K	3500	4.50	VIII
	7.5	3	F	3500	5.25	VI	8	L	3500	5.00	VIII
	10	4	G	3500	5.75	VI	9	M	3500	5.40	VIII
	15	5	H	3500	6.50	VI	B	N	3500	6.10	VIII

*Option Code refers to the Hydronics Option (position 12) in the model number. See the 30RAP nomenclature on page 4 for option identification.

NOTE: Pump selections are chiller size dependent. For example, option code 5 on a 30RAP010-030 chiller is not the same as option code 5 on a 30RAP035-045 chiller.